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NOVEMBER, 1958

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- DIE CASTINGS
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- POWDER METALLURGY
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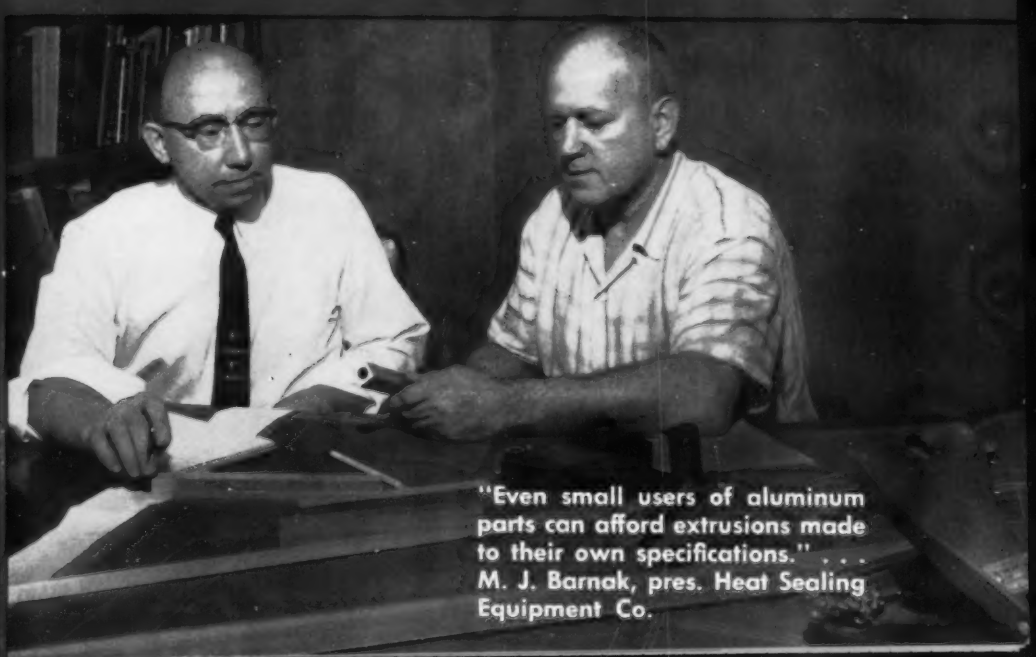

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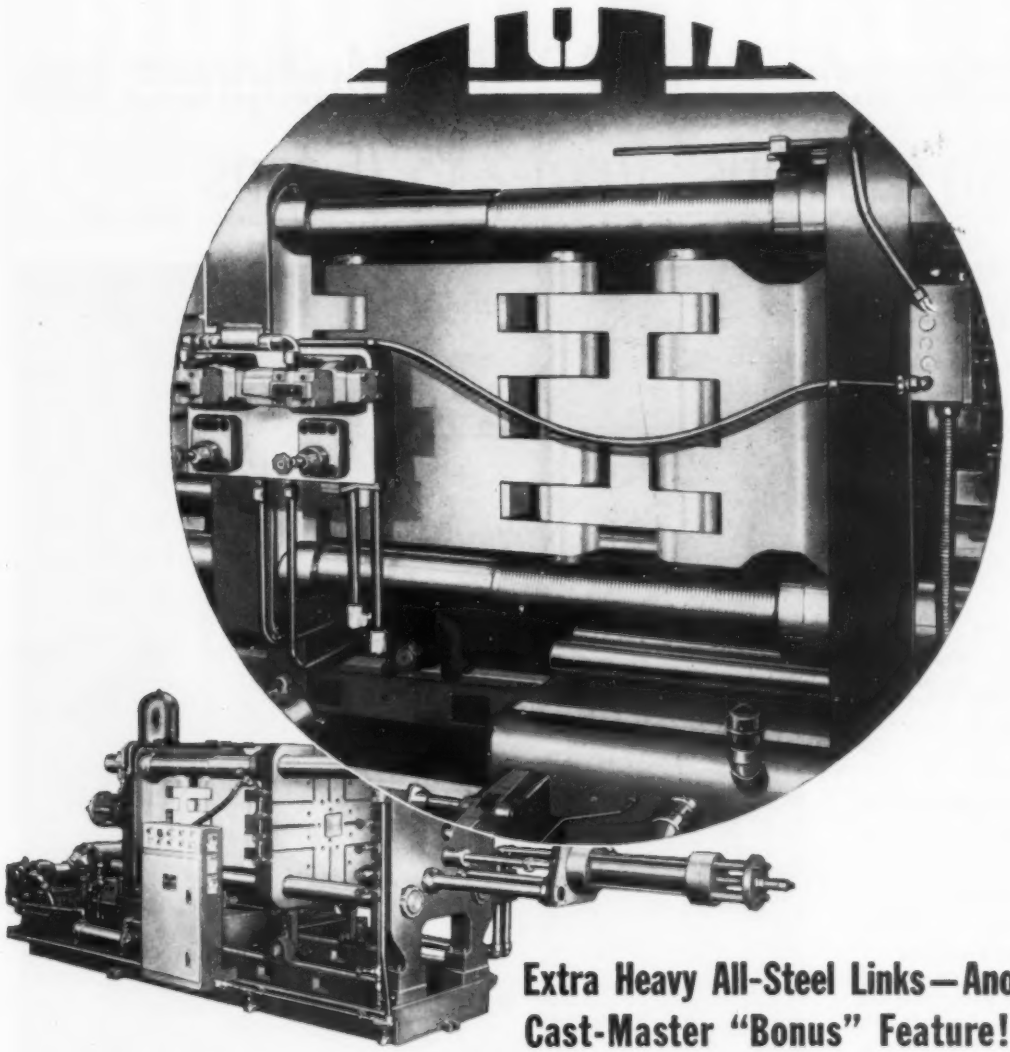

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The story of Cast-Master quality is a story of "bonus" features — like the link system shown here. Cast-Master links are super-rugged — all-steel — machined — with wide spread for positive lock-up, and multiple shear points to eliminate link pin breakage. Result? — more precision — lower maintenance costs for Cast-Master owners. To get the complete "bonus" story, send for the new Cast-Master catalog.

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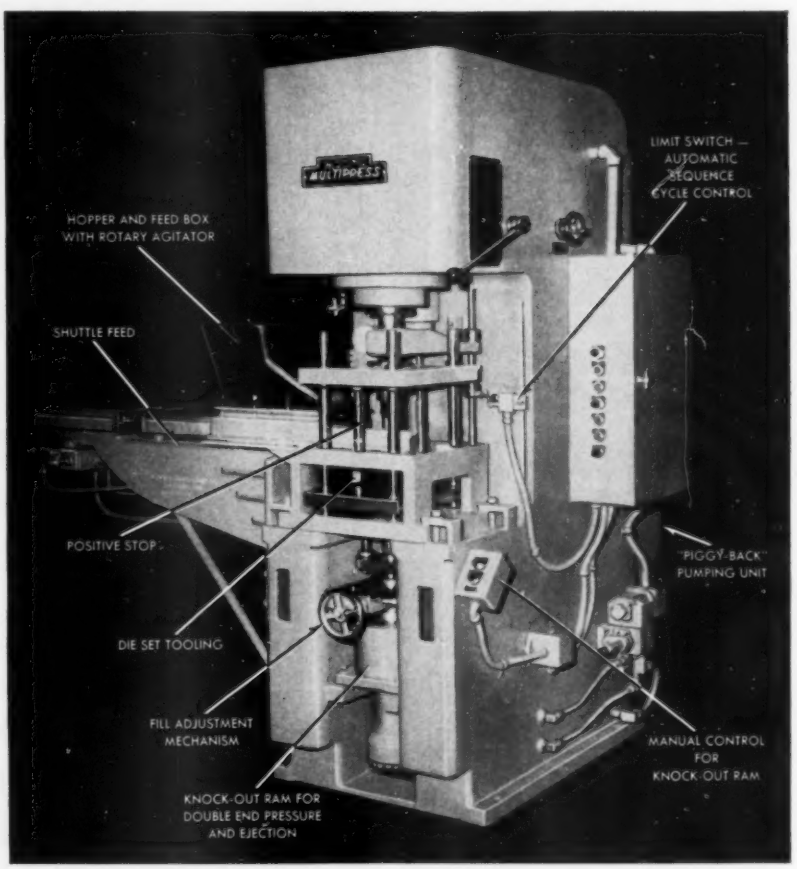
UNIFORM CROSS-SECTIONAL DENSITY of compacted parts is assured by application of double-end pressure. And, where necessary to improve density, exclusive *Vibratory Ram Action* can also be applied.

ADJUSTABLE FILL FEATURE allows adjustment of the volume capacity of the die even while the press is in operation. Result is fast, simple setup changes—and ability to *compensate for variations in material* (particle size, moisture content, etc.) from batch to batch.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KNOCK-OUT RAM FOR DOUBLE END PRESSURE AND EJECTION

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Write for full details in Bulletin M-11-B

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IN THIS ISSUE

November 1958: Volume 16 Number 11

COVER

THE VERY LOW COST of extrusion dies and the speed with which tooling can be changed lets the small user of extruded shapes design for the best shape and then order in small quantities. That's why the Heat Sealing Equipment Co. has been able to get the precise shape they want and thus put out a better product at a lower price. Shown on our cover are; M. J. Barnak, president (left) and Frank Pizmoht, partner, (right) examining an extruded shape for use on their heat sealing equipment.

FEATURE ARTICLES

23 EXTRUSIONS REDUCE RETAIL PRICE 20-50%
Extrusion dies are so inexpensive that the manufacturer of special equipment need not hesitate to design a special shape. Short runs of as little as 25 to 50 pounds of aluminum can be made economically.

24 WHO USES SINTERINGS?
A few examples of the many different applications that are currently designed for powder metallurgy.

28 DESIGNING FOR DIE CASTINGS — TOLERANCES
One of the leading commercial die casters tells what should and should not be done when specifying cast tolerances. For lowest cost castings follow these recommendations.

30 DESIGN PROPERTIES OF SINTERINGS
Last month the mechanical and physical properties of non-ferrous sinterings were given. This month the same data for ferrous sinterings.

34 BUILD YOUR PRODUCT WITH ZINC DIE CASTINGS
The design flexibility of the zinc die casting process lets this company get the best design and functional properties in their product.

35 COMING!! 3400°F ALLOYS
A quick look into the future holds great promise for the investment casting of new super-alloys.

36 MACHINING OF COBALT SUPERALLOYS
If the designer is going to use the superalloys, the production men must know how to machine them. This condensation gives some of the highlights from a complete report on machining.

39 DESIGN TIPS
More ideas on specifying dimensions and reference surfaces on extrusions for lowest cost manufacture and inspection.

44 PROPERTIES OF EXTRUDED ALLOYS
The elevated temperature properties of some aluminum extrusion alloys are given in this month's table.

57 CUT DOWN THOSE OVERWEIGHT CASTINGS
By converting from a sand casting to a plaster mold casting, weight can be saved and a better product made.

59 YOU CAN CAST LARGE, COMPLEX SHAPES
Through the use of plaster mold castings and a unique method of making cores, large castings can be made to close dimensional tolerances.

65 COST AT ASSEMBLY . . . 30% LESS
Another case of outstanding saving in manufacturing cost made possible by switching to die castings.

FINISHING SECTION

43 ANODIZED ALUMINUM EXTRUSIONS
Designers who want or need color on their products will do well to investigate anodized aluminum extrusions. Almost any desired color can be gotten for either indoor or outdoor applications.

46 HOW TO FINISH SINTERINGS IN A BARREL
Finally a technique has been developed that allows the savings characteristic of powder metallurgy to be maintained in the finishing department.

DEPARTMENTS

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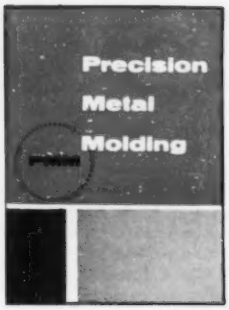
40 Data in Ads
70 Opportunities
52 Useful Literature
60 New Products



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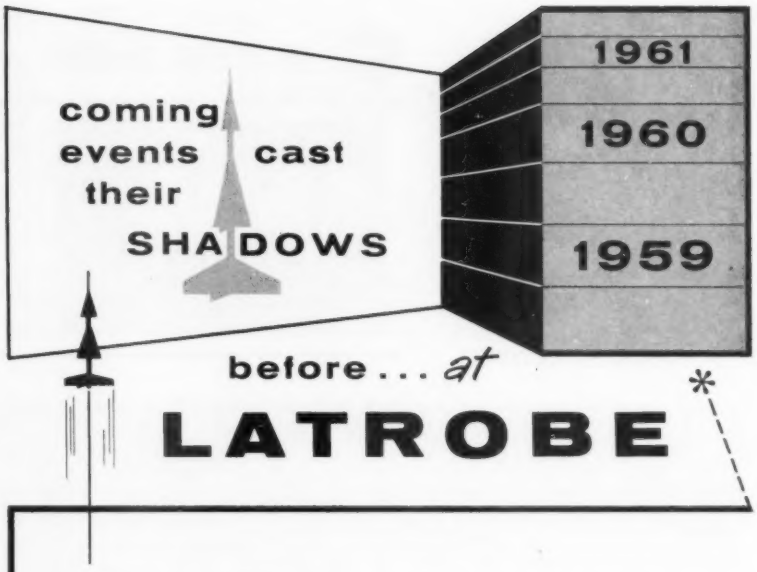

Months and months ago, Latrobe produced intricate parts and shapes for many new products scheduled in 1959 and the years beyond . . .

Long before these designs of "things-to-come" were completed on the drawing boards, those behind the products had turned to Latrobe! For they knew from past experiences and performances, Latrobe has the facilities to produce quality Die Castings!

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How they cut costs, broaden the application of powder metallurgy!

The big news in powder metallurgy continues to come from Republic. As a result of Project 501, Republic has developed and is producing at its Toledo, Ohio, plant, two types of carbon compatible iron powders. Designated as types MS and HS 6460, these powders represent a major advancement for the powder metallurgy industry. They are suitable for present and new applications previously restricted to other materials. Here is how they can cut your costs and broaden the application of powder metallurgy.

TYPE MS is a soft, higher purity powder with excellent carbon compatibility. It can be used for comparable strength structural parts at *lower cost* than obtainable with copper. With the addition of 1% graphite, MS can provide physical properties previously attainable only with 7-10% blended copper.

MS is ideally suited for use in electrical part and electric motor applications — pole pieces, cores, permanent magnets, armatures.

The softness of MS makes possible the fabrication of larger parts on normal pressing equipment.

TYPE 6460 HIGH STRENGTH ALLOY POWDER is suited for use in all major applications of ferrous powder metallurgy because of its excellent compressibility. It makes possible higher tensile strengths than ever before achieved with ferrous powders on existing production equipment.

Can be used for comparable strength structural parts at lower manufacturing costs than obtainable with copper infiltration. Excellent carbon compatibility enhances its ability to be heat treated. Additional manufacturing economies can be obtained because fewer operations will be required to obtain high density, higher strength parts.

For technical data on Carbon Compatible Powders, write Dept. PM-6609, 1441 Republic Building, Cleveland 1, Ohio.

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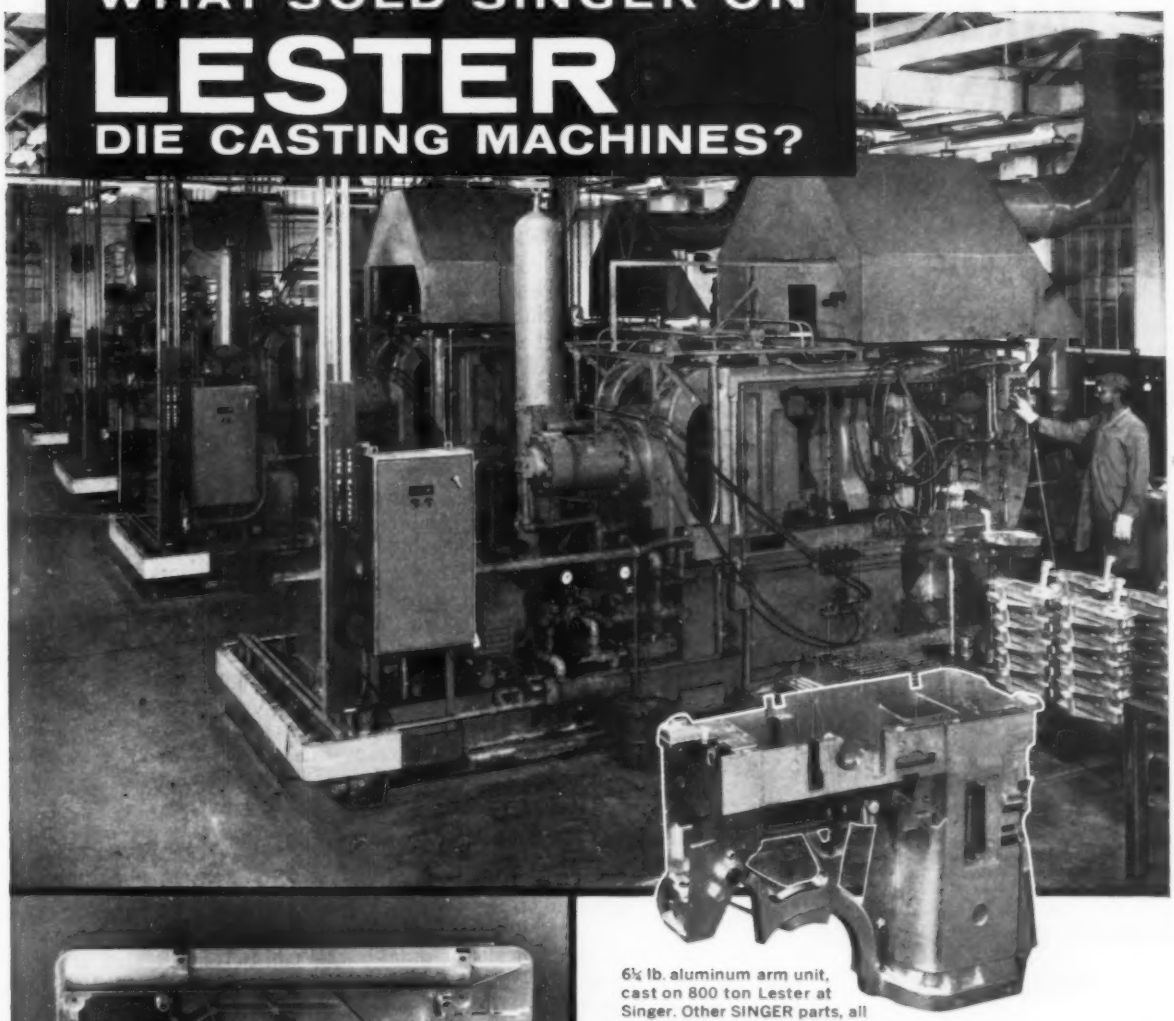
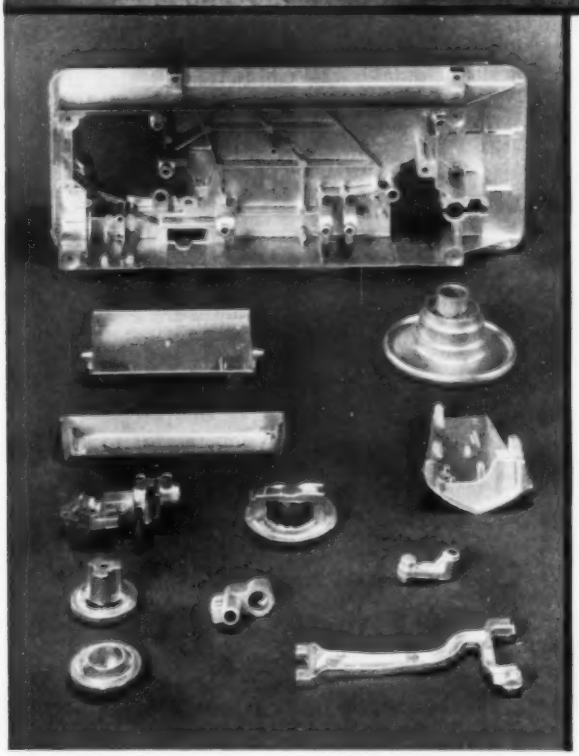
WHAT SOLD SINGER ON LESTER DIE CASTING MACHINES?





6¼ lb. aluminum arm unit, cast on 800 ton Lester at Singer. Other SINGER parts, all cast on Lesters, shown at left.

What sold SINGER on Lesters? The basic rigidity of the one-piece frame which can be depended upon to tightly lock and keep locked even the largest of their dies, the main arm unit for their new model #401 SLANT-O-MATIC Sewing Machine. With this dependable clamp, they obtain consistent production of quality castings, with finish and density they have been otherwise unable to obtain.

As a result, Singer has installed 15 Lester Die Casting Machines of 800 ton and 600 ton capacity in their plant in Elizabethport, New Jersey.

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PMM CASTING ABOUT

technical news of applications & processes involving precision metal moldings

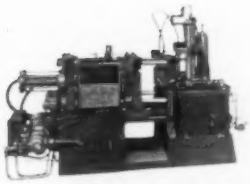
HIGH PURITY MOLYBDENUM PELLETS for use as melting stock for the super-alloys have been developed by General Electric Co. The new pellets are designed specifically for the vacuum melting techniques which are becoming more and more widely used today. Because vacuum melting removes all volatile oxides, dissolved gases and other "pumpable" impurities, it is possible to make alloys by this method that are far purer than those melted either in air or under a protective atmosphere. The importance of molybdenum to the super-alloy field is shown by analysis of over 100 of these alloys; an average of 5% molybdenum content is shown. The new pellets are high density (8.0 g/cc min.), have a low gas content (under 100 ppm), uniform size and weight.

NEW TITANIUM ALLOYS are being developed that will measurably broaden the field of application for this metal. The latest ones are from Mallory-Sharon Metals Corp. who have four new alloys said to be radically different from any others. The new alloys were developed specifically for aircraft and missile applications. One of these alloys MST-2½A1-16V is an age hardenable material. It has a yield strength, as solution treated below 65,000 psi and elongation over 10%. By proper aging the ultimate tensile strength can be increased to 200,000 psi. The material will have applications in honeycomb structures. This alloy has a heat treatment cycle that coincides with the brazing cycle for honeycomb structures.

Another new alloy, MST 821, contains 8%A1, 2%Cb, and 1%Ta. This alloy is easily arc-weldable and still retains its high ultimate strength and ductility. It has good high temperature strength and is expected to raise the useful temperature range of titanium alloys by at least 150°F. Two other alloys are MST 185 has exceptionally high strength in the annealled condition and can be heat-treated to 260,-000 psi ultimate tensile strength. Alloy MST-3A1-2½V was developed for the manufacture of tubing. It is weldable and formable and can be flared 50% or more. This alloy, after heat-treatment, has an ultimate tensile strength of about 120,000 psi.

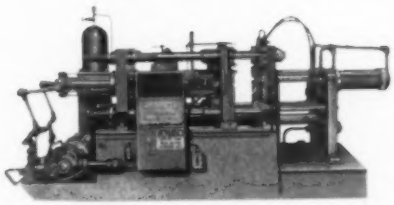
EFFECTIVE RECOVERY OF ZINC FROM DROSS AND DIE CAST SCRAP has been put on a large tonnage basis through the use of a distillation process developed by General Smelting Co. The dross and scrap are charged into a retort and heated to the boiling point of zinc. Vapors collect in a condenser as liquid zinc and are then sent to a holding furnace. Either slab zinc or zinc dust can be produced. Success of the process, on this large scale, is possible by the development of techniques for making and machining extra-large graphite retorts. The king sized retorts, made by Joseph Dixon Crucible Co., are six ft. high and up to three ft. in diameter. They weigh about 750 pounds each. Normal operating temperatures are from 2100 to 2300°F.

MACHINE TOOL SALES ARE THE BAROMETER OF CAPITAL goods spending. That's why economists watch the weekly sales figures of this industry with care. Even a slight upturn in the sales curve can indicate a healthier climate for the capital goods industries. In recent weeks, there has been a definite increase in machine tool sales.



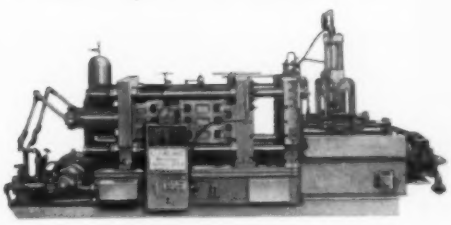
50

Model 50 Cleveland
50-ton locking pressure*
Max. weight of shot, 2.6 lbs.
alum.; 5.4 lbs. zinc



200

Model 200 Cleveland
200-ton locking pressure*
Max. weight of shot, 4.9 lbs.
alum.; 12.5 lbs. zinc

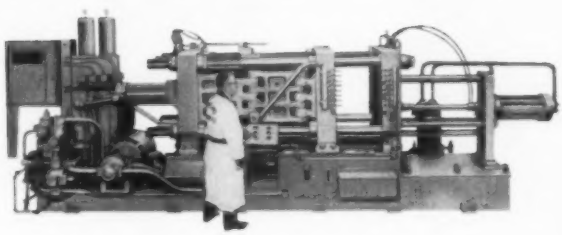


400

Model 400-N Cleveland
400-ton locking pressure*
Max. weight of shot, 9.6 lbs.
alum.; 14.5 lbs. zinc

500

Model 500-N Cleveland
500-ton locking pressure*
Max. weight of shot, 9.6 lbs.
alum.; 14.5 lbs. zinc



650

Model 650 Cleveland
650-ton locking pressure*
Max. weight of shot, 10.6 lbs.
alum.; 25.8 lbs. zinc

800

Model 800 Cleveland
800-ton locking pressure*
Max. weight of shot, 20.1 lbs.
alum.; 47.6 lbs. zinc

adds up to 1000

Model 1000 Cleveland
for Aluminum
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*Locking pressure strain gage tested.

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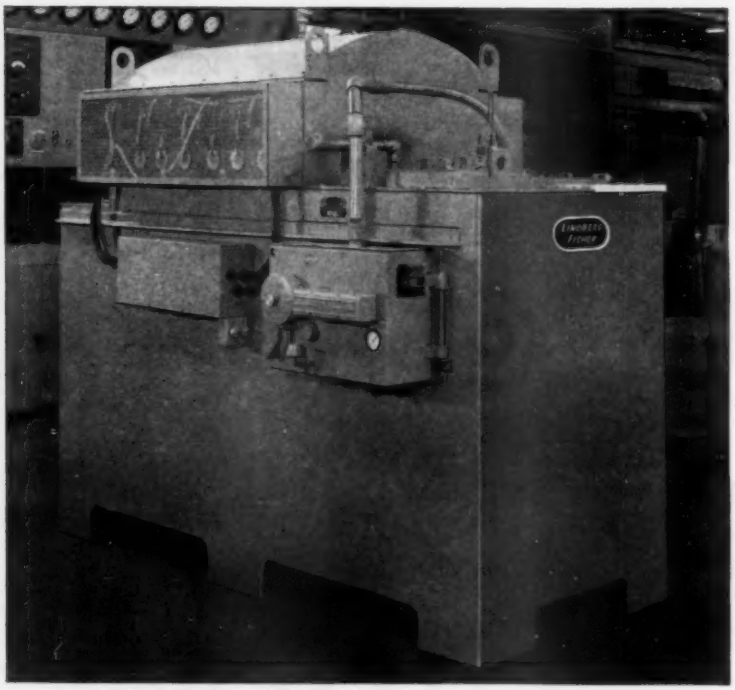


This is Little Joe, the Lindberg Autoladle, the first practical automatic aluminum ladling unit yet devised. An exclusive feature of Lindberg electric resistance holding furnaces, "Little Joe" makes automatic casting of aluminum fast, dependable and economical.

Electric resistance holding furnaces for aluminum have been a specialty of Lindberg engineers for years. These furnaces have proved themselves in superior operation in varied industries, the world over. Now Lindberg offers a complete line, newly-designed, available in capacities of 1,000, 1,500, 2,000, and 3,500 lbs. If your production processes require proper holding of aluminum you can depend on Lindberg to provide just the right equipment for the most efficient and practical answer to your problems.

Lindberg makes a wide variety of melting and holding furnaces for aluminum, brass, bronze, tin, zinc, lead and other non-ferrous metals. These include aluminum induction, nose-pouring crucibles, electric resistance holding furnaces and big reverbs. For foundry, permanent mold or die-casting plant, independent or captive, there are Lindberg melting and holding furnaces to fit every need.

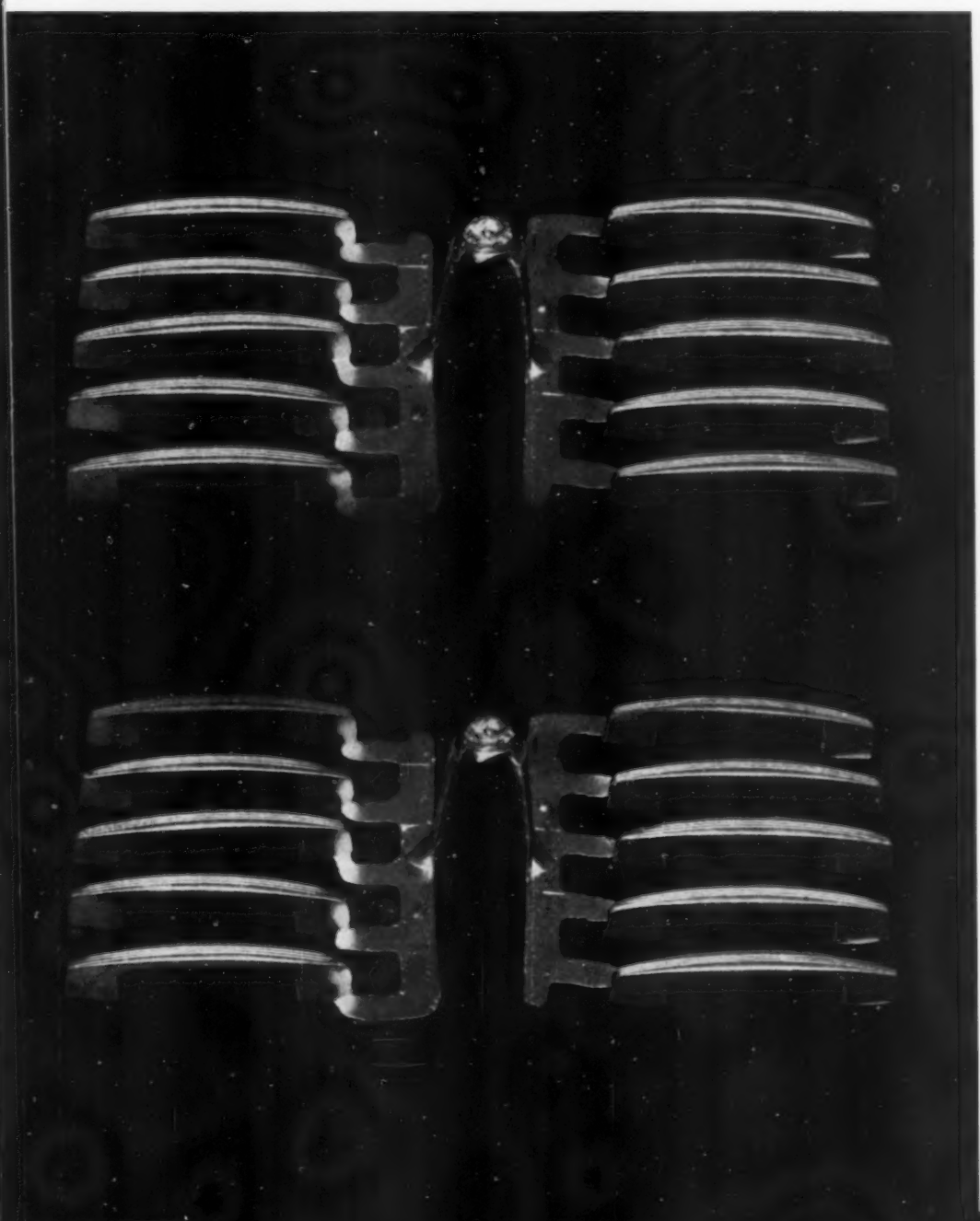
If your problem in this field needs a special solution Lindberg's design staff can find it. Just get in touch with the Lindberg plant or the Lindberg Field Representative in your locality, or write Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Avenue, at Downey, California.

LINDBERG heat for industry

For more information circle No. 36 on the Reader Service Card

Completely controlled production provides you with die cast metals of highest purity and uniformity. Federated Di-Metal is made from special high grade zinc, electrolytically refined by Asarco-developed processes. Production is now concentrated "under one roof" at Corpus Christi, Texas, one of the world's largest plants producing special high grade zinc. Integrated production—controlled from mine to finished alloy—assures you of lower cost Zinc Di-Metal of the highest purity and uniformity. Federated can serve your Di-Metal needs through 22 sales offices throughout the country. There's one near you. Federated Metals Division, 120 Broadway, New York 5. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

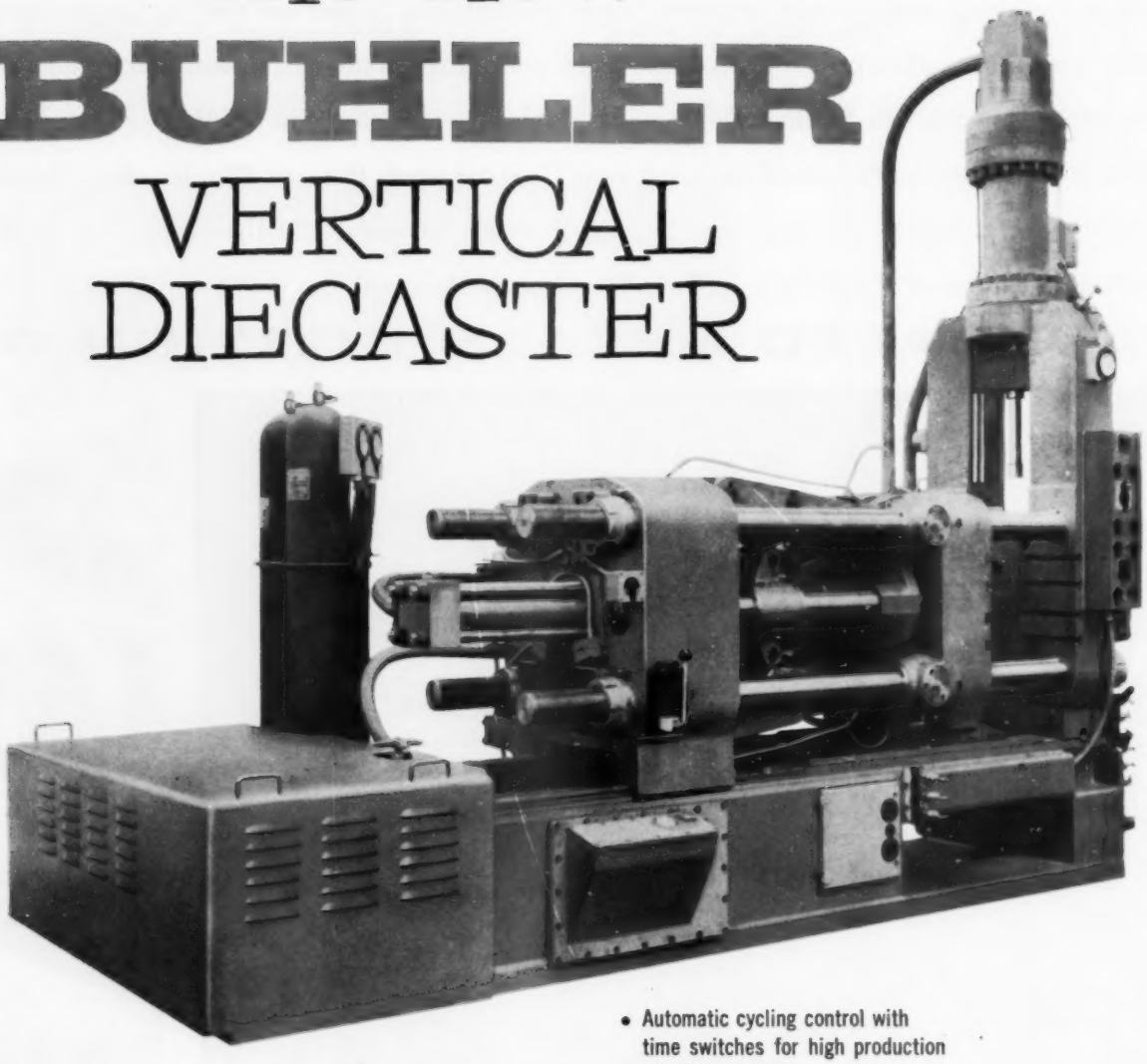
FEDERATED METALS DIVISION OF



ASARCO

AMERICAN SMELTING AND REFINING COMPANY

the new BUHLER VERTICAL DIECASTER



features

- Automatic cycling control with time switches for high production of solid castings.
- Central feed with high injection force. Eminently suitable for thin walled aluminum and magnesium castings.
- Locking force: Size V-100 110 tons
  V-300 330 tons
- Large pressure lines for maximum injection speeds.

Write for complete details.

Engineers for Industry
Since 1860

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130 COOLIDGE AVENUE, ENGLEWOOD, NEW JERSEY

BUHLER BROTHERS, (CANADA) **LTD.**
24 KING STREET WEST, TORONTO 1, ONTARIO

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DUCTILITY Without VULNERABILITY

. . . that's what continuous line galvanized sheet steel provides

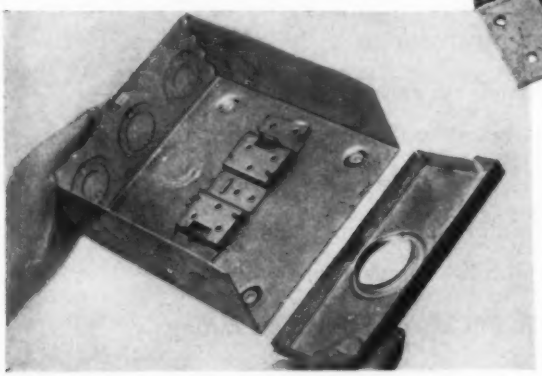
Zinc Coat Flows With The Base Metal . . . Does Not Chip, Flake, Powder or Peel

Using progressive dies on 160 and 250 ton presses, Murray Manufacturing Corp. of Brooklyn forms these 4-piece meter box assemblies from 16-gage mill-galvanized strip and coil steel.

Torturous 90° bends, compound curves, piercing and crimping fail to break down the corrosive-resistant zinc coat that must withstand year 'round exposure to weather.

Continuous line galvanizing has given sheet metal users a formable material fully pre-protected with zinc.

Meter trough and top. 250 ton press pierces and forms — extrudes and curls collar. Severe forming fails to break zinc to steel bond. At left, meter bridge is formed on a six-stage progressive die in 160 ton double-crank press then riveted to trough.



Shown are trough and top end wall formed on progressive dies under 160 tons force. Note sharp corners and crimping area with zinc coating unimpaired.

ST. JOSEPH LEAD COMPANY

ST. JOE

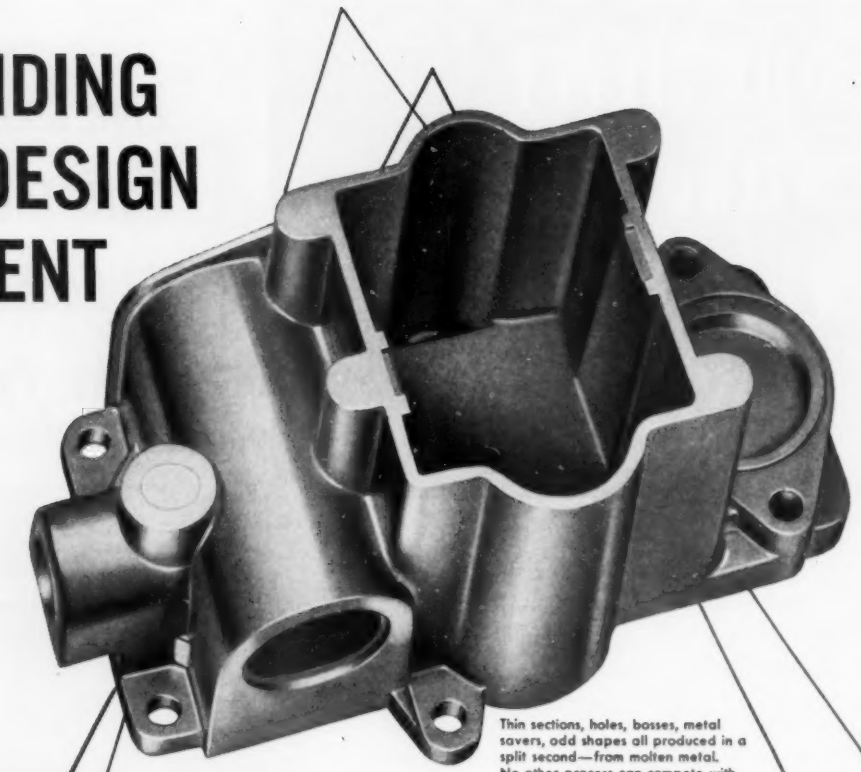
250 PARK AVENUE NEW YORK 17, N. Y.

ST. JOE *electrothermic* ZINC

- HIGH GRADE
- INTERMEDIATE
- PRIME WESTERN

ZN-114

PYRAMIDING DESIGN TALENT



Thin sections, holes, bosses, metal savers, odd shapes all produced in a split second—from molten metal. No other process can compete with this for eye appeal or low cost.

with MADISON-KIPP zinc and aluminum die castings

When product designers send preliminary drawings for critical review by the seasoned Madison-Kipp mechanics, it has often proved to be the decisive factor in the ultimate design of the component parts.

The original designer thoroughly understands the function of his product. We thoroughly understand die casting and machining problems. Combining the two skills at an early period of development is logical and valuable.

Our customers of long standing always utilize this system which virtually pyramids design talent for successful high production manufacturing.

Please clip this ad as a reminder to contact us when you have die casting requirements.

kipp

MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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It's a fact...

Petro Bond* sand assures...Higher Quality Finish In Brass and Bronze Castings

Sands bonded with PETRO BOND use oil instead of water.

PETRO BOND sands . . . produce less gas in the mold . . . therefore finer grain sands may be used resulting in smoother mold and casting surfaces.

PETRO BOND sands are oil-wet and do not adhere to cast metal thus clean-up time is reduced.

PETRO BOND sands are reusable with only infrequent remulling and rebonding.

PETRO BOND sands have proved their superiority in scores of foundries.

Write today for BOOKLET giving further information on the benefits gained by using PETRO BOND by BAROID.

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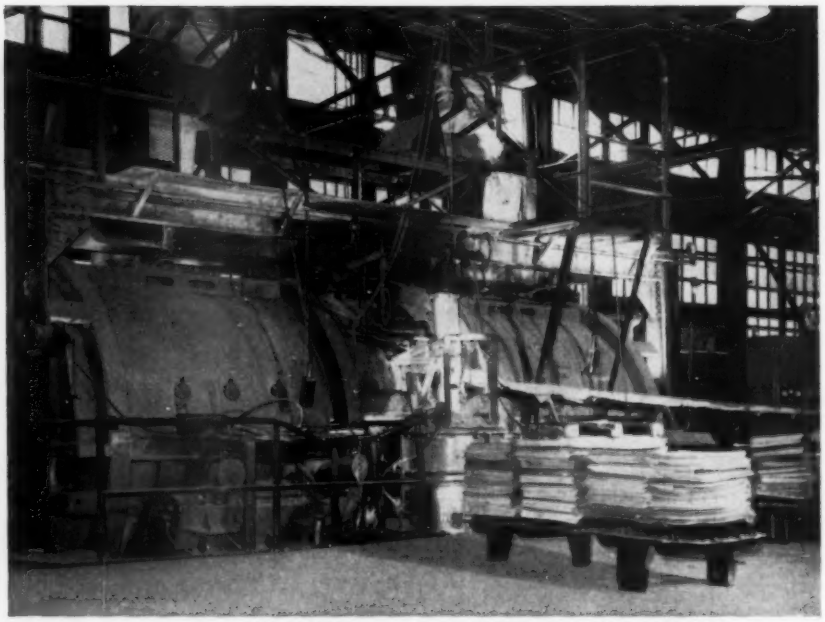
PETRO BOND is available from dealers listed herewith:

Alabama—Foundry Service Co., Birmingham. **California**—Independent Foundry Supply Co., Los Angeles 22. **California**—Industrial & Foundry Supply Co., Inc. of California, San Francisco 3. **Illinois**—American Steel & Supply Co., Chicago 28. **Illinois**—John P. Moninger, Elmwood Park. **Illinois**—Steelman Sales Company, Chicago 4. **Illinois**—Western Materials Company, Chicago 3. **Illinois**—Marthens Company, Moline. **Massachusetts**—Klein-Farris Co., Inc., Boston 11. **Michigan**—Foundries Materials Company, Coldwater. **Michigan**—Foundries Materials Company, Detroit. **Minnesota**—Smith-Sharpe Co., Minneapolis. **Missouri**—Barada & Page, Inc., Kansas City (Main Office). **Missouri**—Mr. Walter A. Zeis, Webster Groves. **New Jersey**—Asbury Graphite Mills, Inc., Asbury. **New York**—Combined Supply & Equipment Co., Buffalo 7. **New York**—G. W. Bryant Core Sands, Inc., McConnellsville. **Ohio**—The Buckeye Products Company, Cincinnati 16. **Ohio**—The Hoffman Foundry Supply Co., Cleveland 13. **Oregon**—La Grand Industrial Supply Co., Portland 1. **Pennsylvania**—Pennsylvania Foundry Supply & Sand Co., Philadelphia 24. **Tennessee**—Robbins & Bohr, Chattanooga. **Washington**—Carl F. Miller & Co., Inc., Seattle 4. **Washington**—Pearson & Smith Distributing Div., Spokane Pres-To-Log Co., Spokane. **Wisconsin**—Interstate Supply & Equipment Co., Milwaukee 4. **Canada**—Canadian Foundry Supplies & Equipment, Ltd., Montreal, Quebec (Main Office) and Toronto, Ont.

For more information circle No. 27 on the Reader Service Card

Birthplace of an Automotive Part

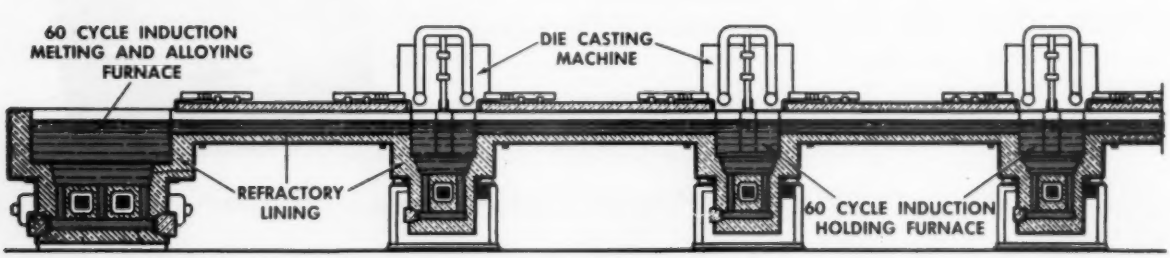


BUNKER HILL SPECIAL HIGH GRADE ZINC SLAB

PRODUCED IN THE AJAX FURNACE

High in the mountains of Idaho, the AJAX-TAMA-WYATT 800 kw induction furnace melts 235 tons of electrolytic zinc cathodes day after day. THE BUNKER HILL COMPANY, originators of Special High Grade Zinc, take pride in the purity (99.99+% Zn) of the slab poured from this 60 CYCLE INDUCTION MELTING unit. Such pure metal insures the soundness of the many zinc die castings used in our cars and appliances.

To maintain this purity when remelting the slab for die casting, hundreds of AJAX-TAMA-WYATT furnaces are used today in our busy industrial regions. The diagram below shows a modern zinc die casting line for automotive parts, using a central 60 CYCLE INDUCTION MELTING and alloying furnace, and holding furnaces at each machine. Connecting electric molten metal runways eliminate all metal transfer labor. Unexcelled metal quality, low metal losses, reliability and economy of operation are assured by using 60 CYCLE INDUCTION MELTING throughout.


60 CYCLE INDUCTION MELTING AND ALLOYING FURNACE
DIE CASTING MACHINE
REFRACTORY LINING
60 CYCLE INDUCTION HOLDING FURNACE

AJAX USA

ENGINEERING CORPORATION

TRENTON 7, NEW JERSEY

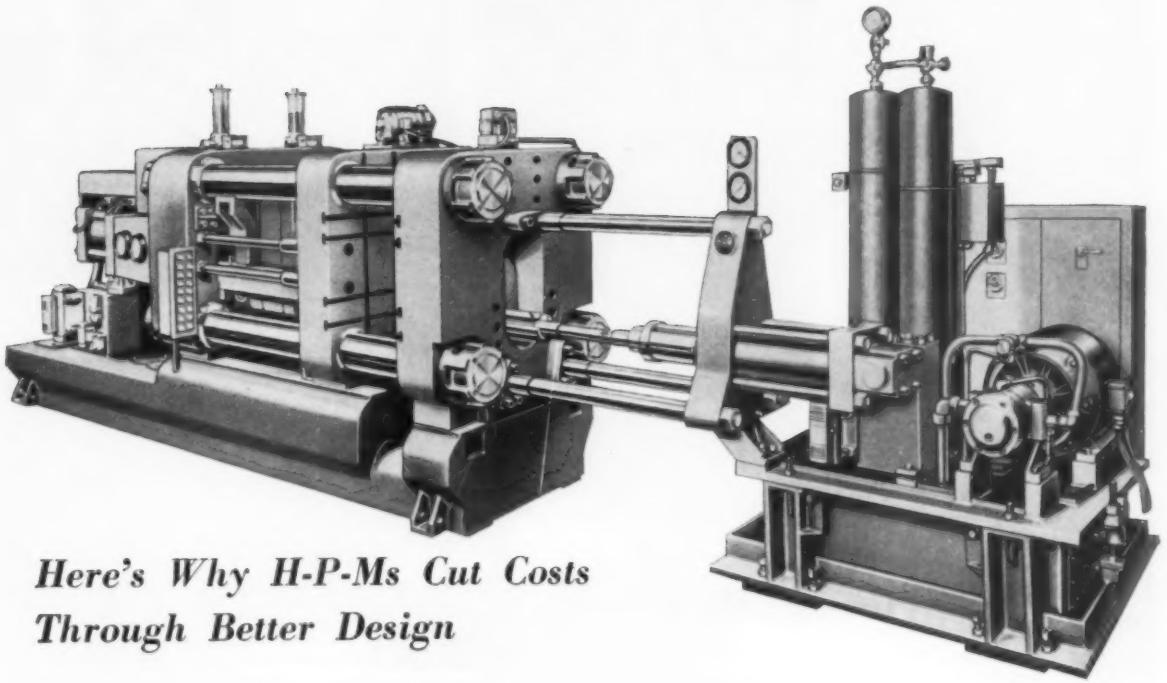
60 CYCLE INDUCTION MELTING

Associated Companies: Ajax Electrothermic Corporation Ajax Electric Company

For more information circle No. 2 on the Reader Service Card

IF YOU DIE CAST . . .

H-P-Ms Give You More For Your Money



Here's Why H-P-Ms Cut Costs Through Better Design

H-P-M die casting machines are the answer to many of today's die casting problems . . . production output to meet any job requirement . . . cleaner castings . . . negligible flash . . . parts produced to accurate dimensional tolerances with improved quality and density. H-P-M's new design, mechanical link wedge clamp and new injection end, results in a new approach to die casting techniques. Here's why H-P-Ms are the best buy:

1. MORE "BEEF"—Heavier platens . . . more die support, less deflection. Larger rods . . . reduced flash, less trimming . . . more casting dimensional control . . . less die trouble.
2. MORE PRESS WEIGHT—Compare price per pound . . . you'll have difficulty finding an equal. In addition . . . H-P-M's many new design features.
3. MORE HORSEPOWER—Clamps to the rated tonnage . . . more pressure cycles per hour . . . higher injection speeds and pressures . . . positive and instantaneous injection follow through.
4. MORE SPEED IN DIE SET-UP—Single central screw adjustment changes daylight and controls tonnage . . . no tie rod nut adjustment.
5. MORE PRESS FLEXIBILITY—No die too complicated or sequence too elaborate. Infinitely adjustable . . . complete control of action, both clamp and injection ends . . . speed and tonnage assured when needed.
6. MORE SAVINGS IN MAINTENANCE—Self-contained clamp and injection ends . . . compact hydraulic power units . . . manifolded high pressure hydraulics . . . automatic lubrication . . . simplicity of mechanical link wedge design.

Write for Bulletin 5400-A, today

THE HYDRAULIC PRESS MFG. COMPANY

A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U. S. A.

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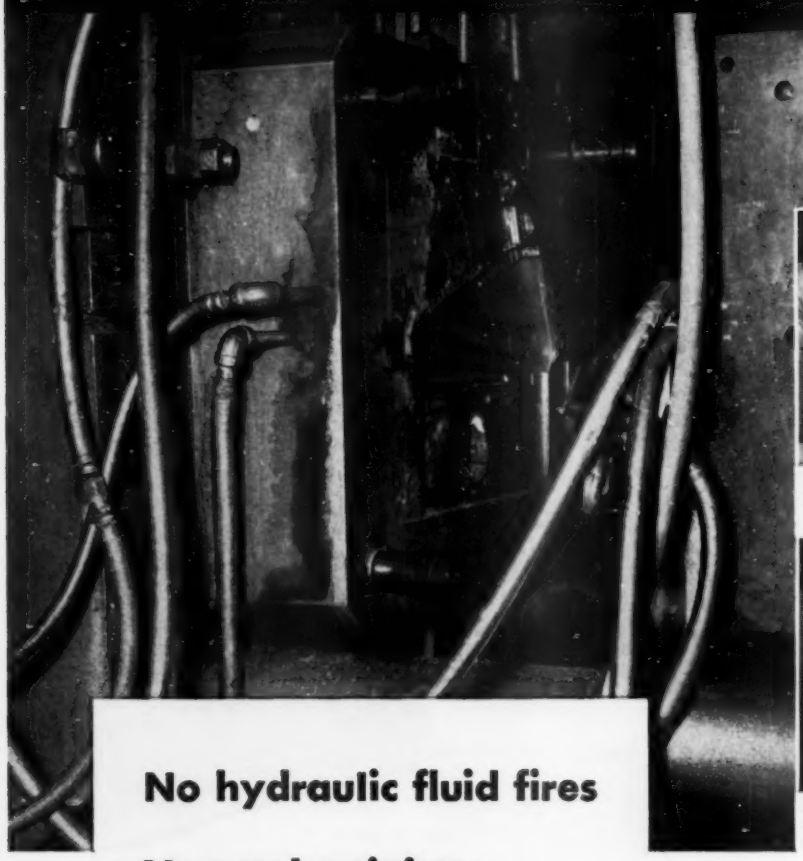
"For 3 solid years—



Irus Fluid's distinctive yellow color makes it easy to spot and trace leaks.

Complexity of lines (left) and pots of molten metals (above) represent the type of fire hazards requiring Shell Irus Fluid 902.

No hydraulic fluid fires

No worker injury

No equipment damage —since we switched over to

SHELL IRUS FLUID 902"

says Ernie Ike, Plant Superintendent
Western Die Casting Co., Emeryville, Calif.

According to Mr. Ike, these results are directly due to the switch-over in 1955 from conventional hydraulic fluids to Shell Irus Fluid 902.

Irus® Fluid 902 is a special combination of petroleum oils mixed with water and emulsifying agents. Its fire resistance is achieved through the relatively high water content. Irus snuffs out fire, *under plant conditions.*

Another important advantage of Irus Fluid 902 is its low cost. Plant operators now using Irus have discovered that Irus Fluid costs up to one-third less than other fire-resistant fluids . . . yet is comparable in performance in every practical respect.

If the hydraulic equipment in your plant is exposed to fire hazards, let a Shell Industrial Representative show you the advantages of Irus Fluid 902. Write Shell Oil Company, 50 West 50th St., New York 20, N. Y. or 100 Bush St., San Francisco 6, Calif.

SHELL IRUS FLUID 902

a low-cost, fire-resistant hydraulic fluid

SHELL

For more information circle No. 48 on the Reader Service Card

No matter what your requirements--

DOLLIN

DIE-CASTING TECHNIQUES provide the low-cost answer!

The great versatility of the die-casting process has been brought to its highest development by Dollin engineers, die-makers, foundrymen and Dollin specially-designed, automatic, high-speed equipment.

Dollin has helped to design and has produced thousands of shapes and sizes with the exact fidelity of design, close tolerance, weight, metal structure and surface finish to meet the requirements of each application.

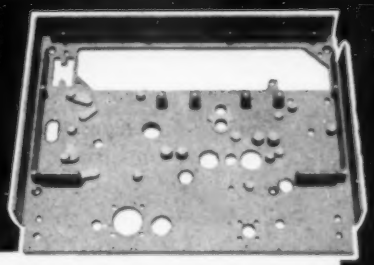
These bonuses go with every quotation from Dollin, at no extra cost. Send prints or samples of any parts for cost-cutting or product-improving suggestions.

LARGE PARTS

Aluminum castings made on large cold chamber type, high pressure machines. Zinc castings made on large plunger type machines.

SMALL PARTS

Zinc castings, 1000 per lb. to 3 per lb., accurately made on fully automatic machines. More design latitude, low tool costs, low piece prices.



INTRICATE DESIGNS

Dollin engineers and die-makers provide practical solutions to complex designs—open new possibilities for the use of die-castings.

EYE APPEAL

Sound, clean castings without surface imperfections permit low-cost buffed finish—provide better base for plating or organic finishing.

HIGH STRENGTH

Correct choice of alloys, scientific control and precise adherence to formula assure maximum strength-to-weight ratio.

DOLLIN Zinc and Aluminum DIE-CASTINGS

DOLLIN CORPORATION, 614 So. 21st, Irvington, 11, N. J.

Sales Offices: Boston • Buffalo • Canton • Charlotte • Chicago • Detroit • Louisville • Philadelphia • Pittsburgh • St Louis • St Paul

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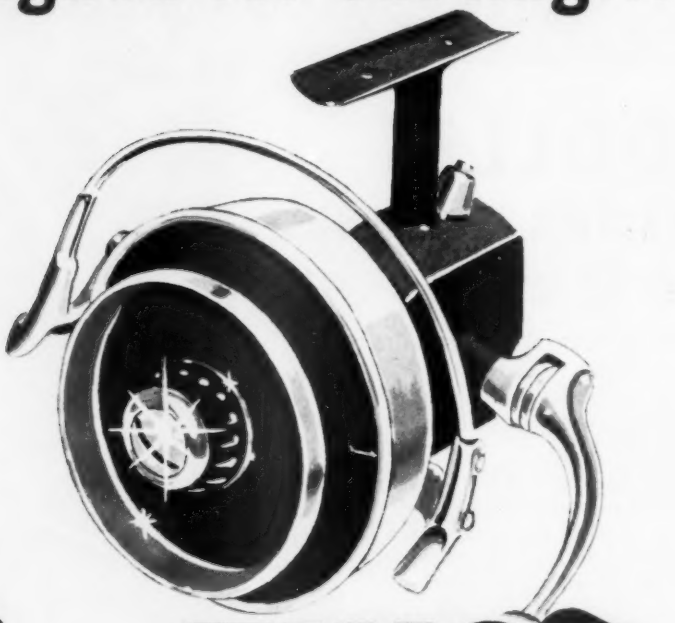
designed for casting...



from TADANAC ZINC

The smooth operation of this modern spinning reel depends on balance and precision . . . hard use season after season demands durability and corrosion resistance. Competitive markets require economy. To meet these demands, the complex working parts of this reel are die cast Zinc!

Backed by one of the world's largest Zinc producers, Tadanac Zinc is the preferred brand with alloyers and die casters who demand consistent high purity, assured supply and prompt delivery.

For information or assistance regarding Zinc die casting operations, contact our Technical Service Staff. Your inquiries will be given immediate attention.

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA LIMITED

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METAL SALES DIVISION: 215 ST. JAMES STREET W., MONTREAL 1, QUEBEC, CANADA
Sold in United States by: AMERICAN METAL CLIMAX, INC., 61 BROADWAY, NEW YORK 6, N.Y., 1 N. LASALLE STREET, CHICAGO, ILL. • THE AMERICAN METAL COMPANY, LIMITED, OF MICHIGAN, 4172 PENOBSCOT BUILDING, DETROIT, MICHIGAN • THE AMERICAN METAL COMPANY, LIMITED, OF CALIFORNIA, NATIONAL OIL BUILDING, SIXTH STREET AND GRAND AVENUE, LOS ANGELES 17, CALIFORNIA

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TADANAC ZINC SHAPES THE THINGS TO COME

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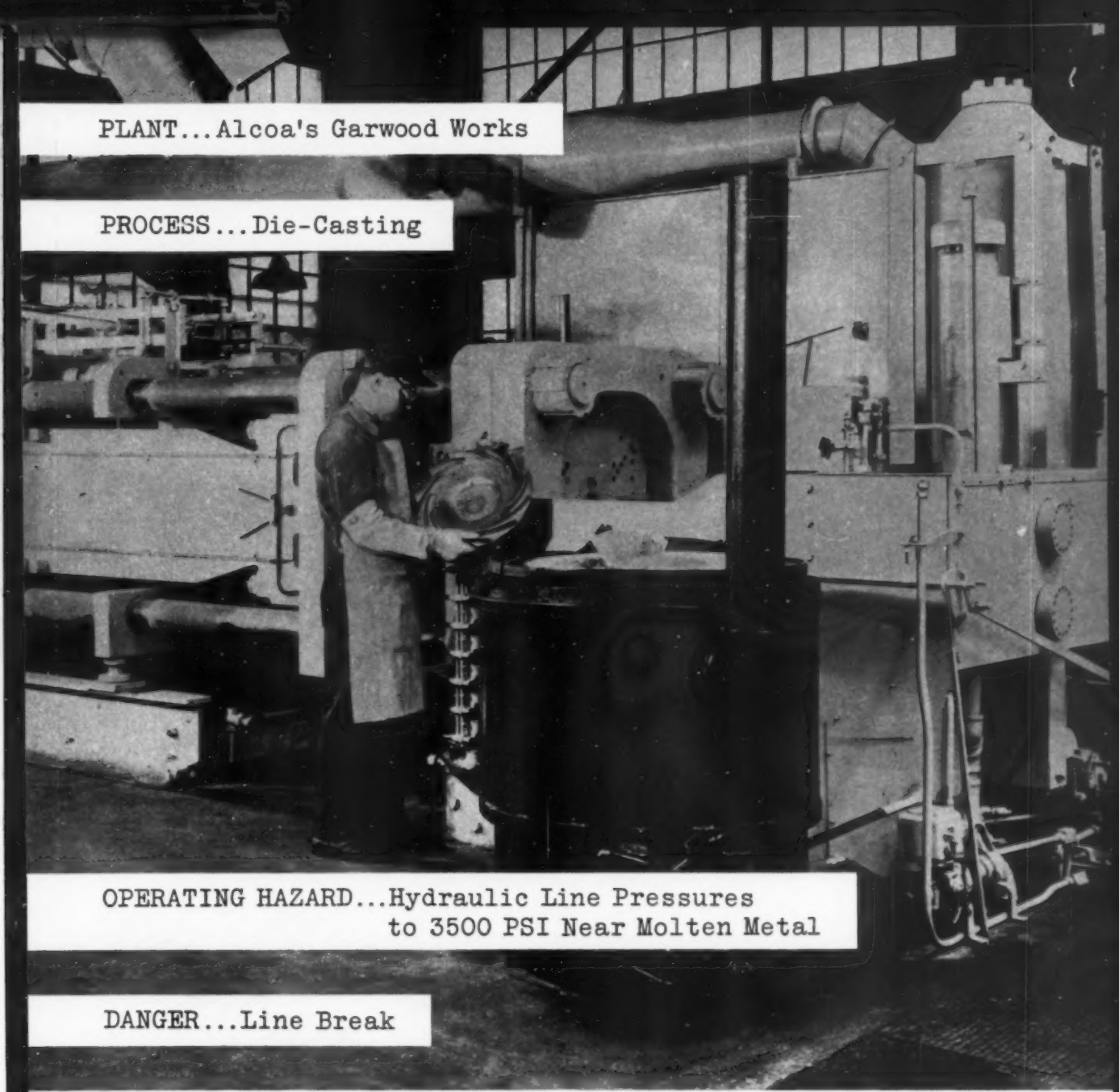
PLANT...Alcoa's Garwood Works
PROCESS...Die-Casting
OPERATING HAZARD...Hydraulic Line Pressures to 3500 PSI Near Molten Metal
DANGER...Line Break

Hydraulic Fluid Used...FIRE-RESISTANT CELLULUBES

A 750-ton cold chamber die-casting machine at Alcoa's Garwood plant. Holding furnace in foreground contains molten metal, is close to pressurized hydraulic fluid lines.

In die-casting operations at its Garwood Works, Aluminum Company of America uses fire-resistant Cellulube hydraulic fluids to minimize the danger of fire in case of a break in hydraulic lines serving the die-casting machines.

Although there have occasionally been line breaks, under pressures ranging up to 2,000–3,500 psi, no serious fires have ever resulted. In addition, Alcoa has found that Cellulube fluids not only perform well as hydraulic media, but lubricate pump parts well.

Cellulubes . . . the *safe* hydraulic fluids . . . are available in six controlled viscosities (90, 150, 220, 300, 550, and 1,000 S.U.S. at 100°F.), one of which is best suited to your operations and the safety of your plant and personnel. If you'd like a sample for evaluation, please let us know the application involved.

Celanese Corporation of America, Chemical Division, Dept. 589-K
180 Madison Avenue, New York 16, New York. Celanese® Cellulube®

Cellulubes... Celanese CHEMICALS fire-resistant functional fluids

Canadian Affiliate: Canadian Chemical Co., Limited, Montreal, Toronto and Vancouver • *Export Sales:* Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y.

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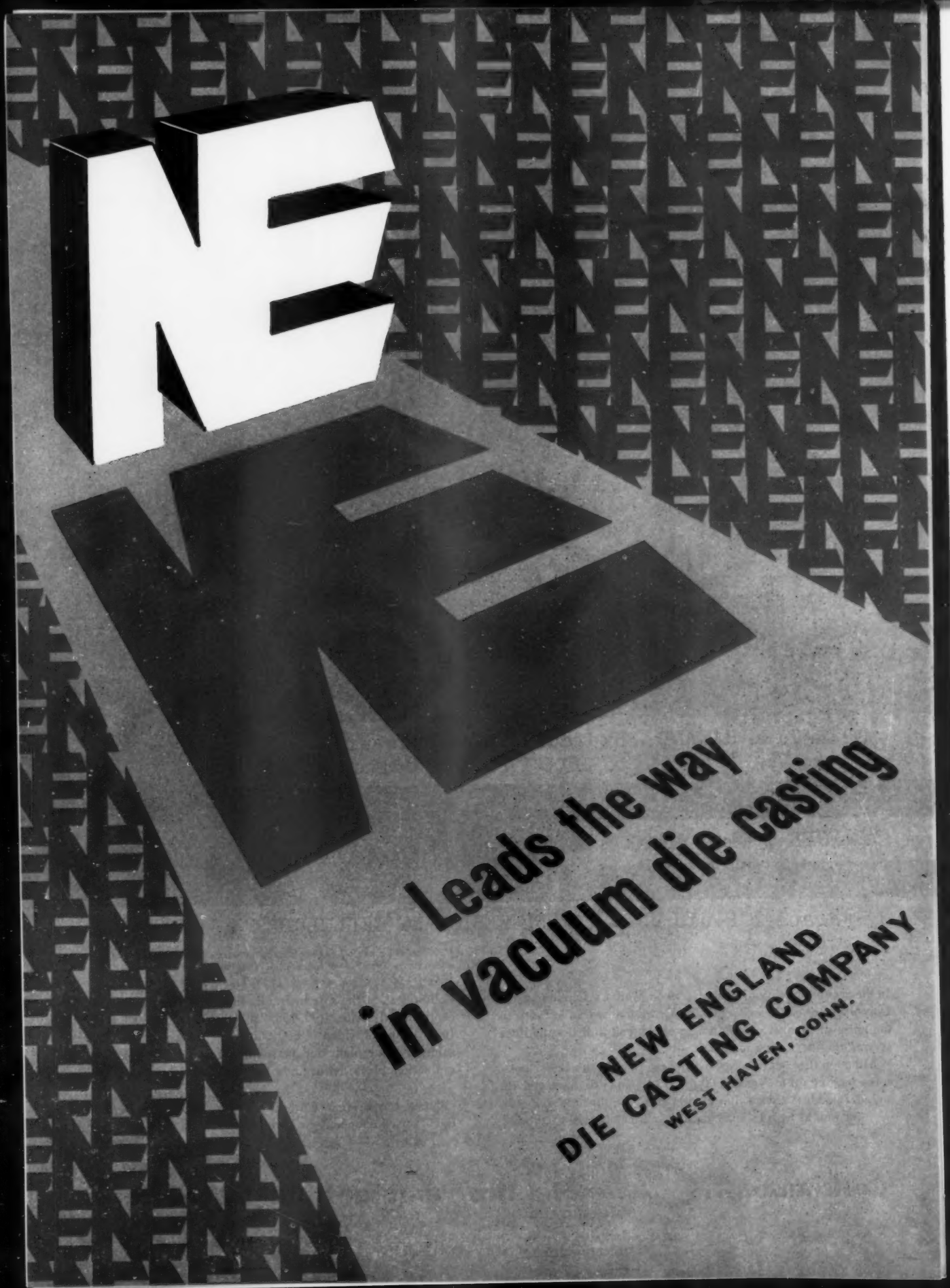
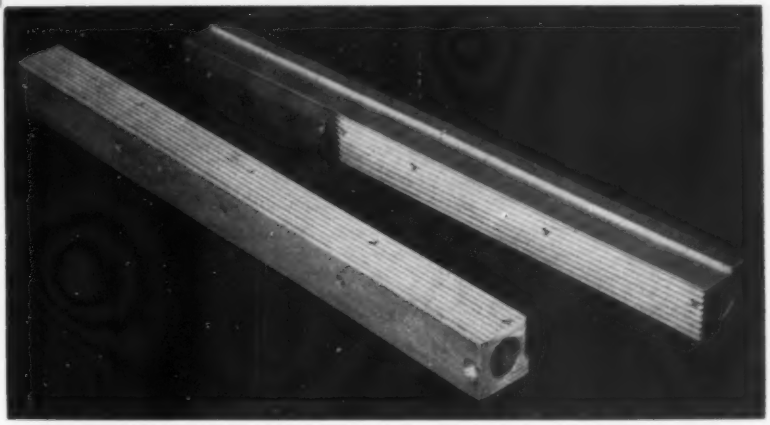

NE
NE
Leads the way
in vacuum die casting
NEW ENGLAND
DIE CASTING COMPANY
WEST HAVEN, CONN.

COVER STORY

EXTRUDED HEAT BARS cut manufacturing costs and gave better heat transfer.

Once machined from bar stock but the change to . . .



THE HALF INCH HOLE is formed during extrusion. Only minor drilling and tapping must be done after cutting the piece to length.

Extrusions Reduced Retail Price 20 - 50%

BY M. J. BARNAK*

THE Heat Sealing Equipment Manufacturing Co. had to be sold on using extruded parts for their Kwik Bag Sealer, but now they're convinced. Extrusions saved them so much money they could reduce the price of their machine from 20 to 50%.

The machines seal film bags used in packaging anything from toys to machine parts. Two bars are used for the heat sealing. They come in various lengths from 8" to 24"; are ⅜", 1" or 1½" wide, and have a ½" hole running through the center.

The heat sealing bars used to be solid 24ST aluminum alloy bar stock, with a ½" hole drilled through from end to end. It was bad enough that it took about 45 minutes to drill through 8" and 12" bars, but labor costs really soared when the 24" lengths had to be drilled. They had to drill two 12" holes, one from each end of the bar, to get through. And, there was never complete assurance that the two holes would exactly meet in the center of the bar. All this machining made the heat sealing bars the most expensive item on the sealing machine.

The heating bars are now extruded in 6061-T6 aluminum alloy by the Aluminum Company of America. The extrusions are delivered in 16-foot lengths from the mill. The Heat Sealing people noted that all machining is avoided except cutting the bars to the desired length. The mill finish was sufficient, eliminating a milling operation to assure flatness of the sealing surfaces. The extruded bar, provided a uniform ½" center hole. This improved the contact between the heating element and the bar, eliminating air pockets and subsequent hot spots. This increased the life of the heating element.

By using extruded bars the company realized:

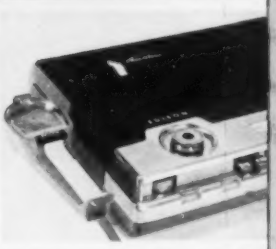
1. A saving of at least $4.00 in labor costs per unit.

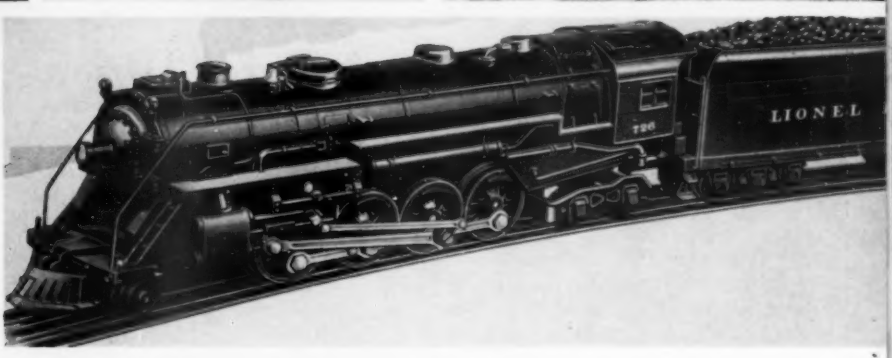
2. A 10% saving in bar material per unit.

These savings made possible the 20% price reduction on the completed machine with a 8" or 12" heat sealing bar, and a 50% price reduction on the 24" bar machine.

The company had a special die designed, as it was impractical to adapt one of the standard shapes. The extra cost, however, was slight, compared to the over-all savings.

*PRESIDENT — GENERAL MANAGER, HEAT SEALING EQUIPMENT CO.





Who Uses Sinterings

IN spite of the great gains that have been rung up by the powder metallurgy industry, there are still vast, untapped markets for sinterings. Under normal business conditions many thousands of tons of small sand castings are used by industry and most of these can profitably be converted to sinterings.

Where-ever a few thousand duplicate castings are used; there is a future market for sinterings.

What, then, are the factors that must be considered when contemplating a conversion to a sinterings.

STRENGTH — this is not a factor since it is very easy to get a sintering that is stronger than a sand casting.

NUMBER OF PARTS — This depends on the fabricator selected. Some custom shops can quote attractive costs on just a few thousand parts, others require very large orders.

TOOL COSTS — Tooling is generally expensive and the saving must amortize the higher tooling costs.

MACHINING — Here's the big saving that sinterings will give. Compare a finished, or nearly finished, product with a rough casting that must be machined.

SCRAP LOSSES — Scrap due to faulty parts such as inclusions, blow holes, etc. are eliminated. Machining losses are negligible.

COMPLEXITY — Often it is possible to make a single

sintering that will replace an assembly.

SURFACE FINISH — Sinterings always have a better surface than castings. It is seldom necessary to do any surface preparation work.

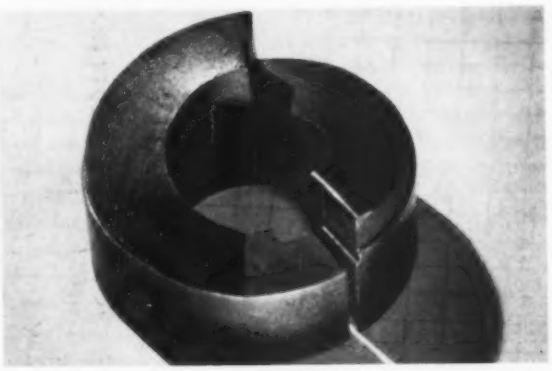
SPECIAL PROPERTIES — Controlled porosity, non-alloyable mixtures and other special properties can be secured in sinterings; they are impossible in castings.

MORE UNIFORM OPERATION of the sintered, oil-impregnated balanced cam has been gained, according to the engineers who selected it for use in hoist-manufacturing.

If the cams were made by usual means, making the helical surface would be very expensive. Self-lubricating properties would not be obtained either.

Made of powdered iron, SAE Type II-B, the brake-cam's rise is .375 in 180°. At the thickest section, it is .875 with a tolerance of plus or minus .005″; at its widest point, the cam is 1.807″, plus 0.000″ and minus 0.002″.

Columbus-McKinnon Chain Corp.



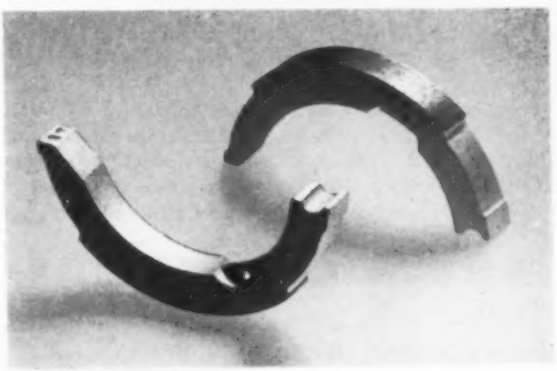
GREATLY REDUCED MACHINING TIME makes the use of this pair of clutch-expansion shoes a time-and-money saver in the manufacture of typewriters.

Used on the centrifugal clutch in an electric machine, they are made of sintered iron. Before using the powdered parts, these shoes were made of cast iron.

The parts are not stressed and are subject to slight frictional wear. As a protection against corrosion, they are tinplated.

The parts are machined before assembly by a spot-facing operation, then are ground on both sides.

The Royal Typewriter Co.



SAVINGS OF 60% BY USING SINTERINGS are estimated by the engineers responsible for the use of this automobile windshield wiper-arm. It is made of powdered iron and is an original design, developed after careful consideration of other processes.

It is subject to wear and stress but not to corrosion. Complexity of the design necessitated transferring powder to the die's lower portion. This accounts for the complex tool design.

Automatic ejection of the part from the die eliminates picking parts off by hand.

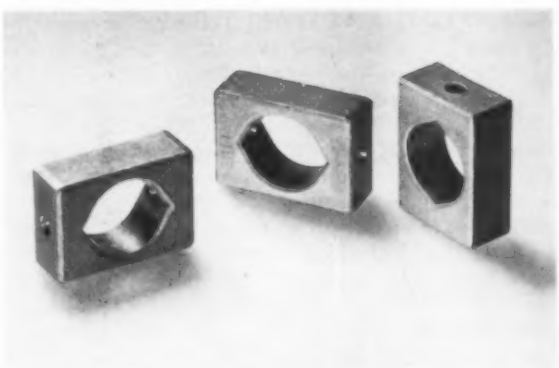
Ford Motor Co.

GREATLY INCREASED QUALITY speaks for itself in these sintered crank-pin slides. They are used in the slides of a gear-housing which is a vital part of a washing machine.

Besides this, they are easier to fabricate and make cost cuts possible.

Once made of machined, cast, grey iron, the slides are now sintered of a blend of iron and copper. One finishing operation is still needed: drilling two holes, 3/16″ in diameter, one in each end of the part. Surface tolerances are 0.001″.

The Maytag Co.



REPLACING SUB-ASSEMBLIES is a major economic function of sinterings in making toys. The toy locomotive wheel was once assembled from a steel tire and a cast center. Scrap rate; 10%. At center is a sintered bearings plate, once assembled from three screw machined parts and a stamping. Scrap rate; 42%. At right, a cluster gear, once made of hobbed and screw-machined parts. Scrap rate: 56%.

The present scrap rate on all three sinterings is: *Nil!* Dimensional tolerances standard to powder metallurgy are well within these needed on those parts. Required porosity is a normal characteristic of sinterings.

Lionel Trains

CONTROLLED POROSITY keeps back-pressure to a minimum with the powdered bronze diffuser seen here. Used on the exhaust-ports of air-powered tools, it is making them almost noiseless.

The diffuser breaks up the force of escaping air by channeling it into the countless minute passages in the sinterings.

Powdered bronze was specified after several tests showed that such things as mufflers, multi-directional deflectors, and screens, were unsatisfactory. Their greatest drawback was lack of controlled porosity.

A characteristic of sinterings is controlled porosity.

Arc Equipment Corp.

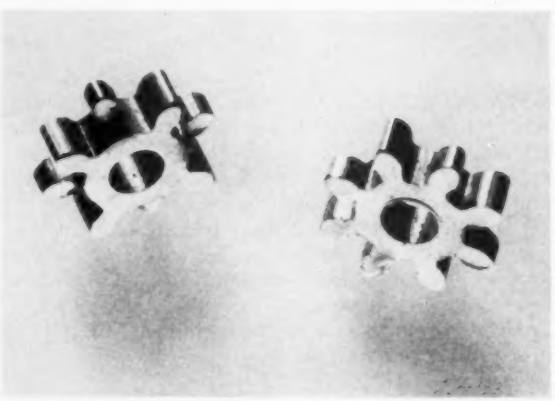
TEN MACHINING OPERATIONS BECAME OBSOLETE when this change-pinion was manufactured of iron powder.

It is used to drive a type-wheel in a time clock mechanism, thus it is subjected to stress, wear, corrosion, and impact.

Dimensional tolerances are very close, being plus or minus 0.001″. The hole-size is closer, plus 0.0000″ and minus 0.0005″.

Cost cutting as much as $150 per 1000 parts is the impressive record since the use of sinterings began in making the time-record machines.

Stromberg-Time Corp.

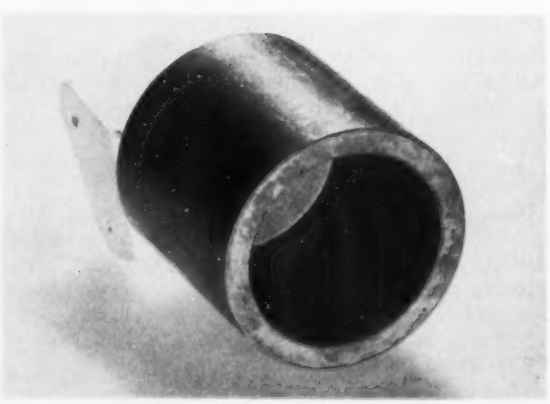


ELIMINATING A SEALING GASKET is possible when this sintered dashpot cylinder is used in manufacturing one of the newest typewriters.

This part is used by the manufacturer without machining. Even so, the cylinder has a dependable inside diameter of 1.3977″/1.4000″. It is made of powdered iron. Together with a sintered piston, this part cushions the carriage-return action.

If another type of part were used, a sealing gasket not only would be needed but the cylinder and piston would have to be fitted with extreme care.

Smith-Corona



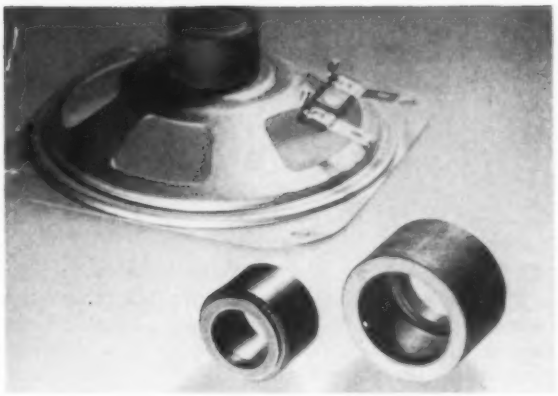
BECAUSE IT PERMITS MORE AUTOMATION IN ASSEMBLY of the speaker, and because it is decidedly more economical, the sintering process is used to make these cups. They are part of the magnetic structure of the speaker, seen in the background, used on television receivers.

At one time they were made of stamped, welded metal parts that pushed the cost up.

Now made of powered iron, a soft metal slug is pressed in one end.

They must be able to withstand the usual corrosive action of natural, atmospheric humidity.

General Electric Co.



LOWERING TOOLING COSTS and much more stable dimensional-controls are benefits gained by using this sintered ratchet in office equipment.

Used for an important indexing function on the business machine, the part is subject to wear and a certain amount of stress. It is also exposed to impact and corrosion.

The corrosive factor has, however, been overcome by impregnating the powdered 1020 steel.

Tolerances are close, being plus 0.001", minus 0.000" on the D-hole dimension. The part is heat treated and wears better than wrought steel.

Underwood Typewriter Corp.

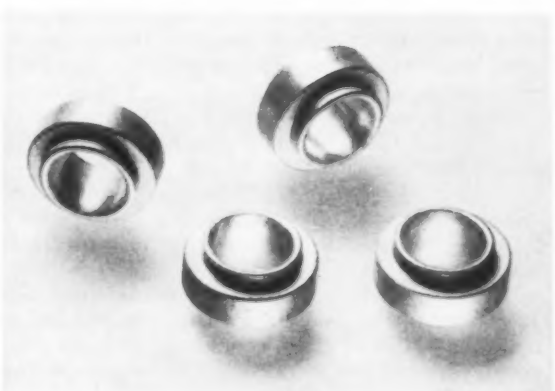
EASE OF FABRICATION is the main reason why a car manufacturer uses these sintered brake-spacers. Once difficult to make, they were produced by means of a screw machine and cold heading.

Now the parts are used as received from their manufacturer, no machining operations are needed.

Once assembled into the modern automobile, they act as spacers between brakes and mounting plates.

They are sintered of powdered iron infiltrated with powdered copper, and have normal dimensional tolerances when completed.

Chrysler Corp.



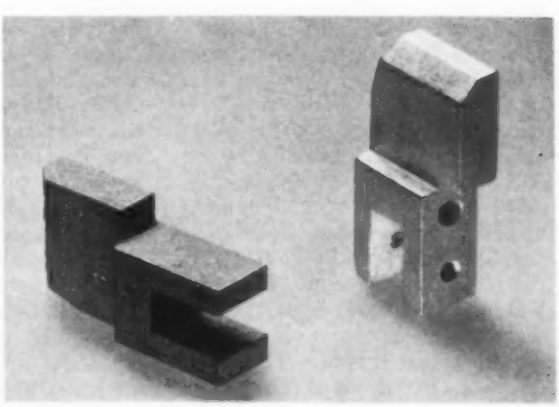
BY ELIMINATING MILLING OPERATIONS, the cost of this part went down when conversion to the use of sinterings became a fact instead of a contemplated idea.

The part is a back-space magnet clapper in a dictating machine.

The shaped part was once milled from bar stock. It is now sintered in magnetic powdered iron.

Only two simple machining operations are needed. Drill two holes and tap one of them. Labor costs are cut approximately 75%. Sinterings need the right powder, then the job's easy.

Edison Voicewriter



DIE CASTINGS

Designing For Die Casting - Tolerances

by RICHARD A. PARKER*

TODAY a great many part designers are familiar enough with the die casting process to specify it as the method of manufacture for component parts. They know that rate of production, reduction of weight, elimination of secondary operations, finer as-cast surface finish, greater strength, and perfect duplication from one piece to another all tend to reduce their subsequent cost. But too many designers are very unfamiliar with the tolerance limitations inherent in the process. The general idea seems to be: "Die Castings can be held to extremely close tolerances" and the designer therefore arbitrarily places a tight tolerance on the dimensions without regards as to the actual needs of the part. True, die castings can be held to very close tolerances, but tolerances which are unnecessarily tight may greatly increase both the original tool cost and the subsequent piece price.

Before examining some examples let us make the following statements. There are what are known as "commercial die casting tolerances" which have been published by the American Die Casting Institute as a guide to both the users and the producers of die castings. Tolerances can be held closer than these, but in most cases at additional cost to the producer and thereby at a higher price to the consumer.

Commercial practice calls for a tolerance of ± .004 inch in aluminum alloy for linear dimensions up to one inch length. Over one inch and up to 12 inches these tolerances should be increased by ± .001 inch per inch in zinc and ± .0015 inch per inch in aluminum. Over 12 inches these tolerances should be increased by ± .001 inch per inch in both metals. These dimensions are for permanent die sections (i.e. not across a parting line or movable core). The basic consideration here is the shrinkage of the piece as it cools. While this shrinkage can be calculated it will vary somewhat due to variations in section thickness, holes cast through the piece, etc. Closer tolerances can be held but here the solution requires that the original tooling be built so that corrections to the tooling can easily be made after sampling and the exact shrinkage determined. This, of course, must be figured in the original cost estimate and results in a higher original tooling cost. Even taking this into consideration the longer dimensions can not be bettered by more than 50% and in most cases this betterment will not meet machining tolerances.

Where the linear dimension is affected by the parting line of the die, additional allowances must be made. In addition to the normal linear dimension tolerance the following tolerances must be applied. Where the projected area of the casting (at the parting line) is less than 50 square inches an additional ± .004 inch for zinc and ± .005 inch for aluminum must be applied. From 50 to 100 square inches this increases to ± .006 inch for zinc and ± .008 for aluminum. Continuing from here the plot closely parallels a straight line. In this case we can again hold to closer tolerances but here the problem involves both original tool construction and actual running of the die equipment. Original equipment must be constructed so as to greatly reduce or completely eliminate any "spring" in the die when the molten metal is injected into it under pressure. Secondly, great care must be taken to keep the mating die surfaces exceptionally clean during the production run thereby slowing down the casting cycle and raising the piece price.

All walls on die castings which are at 90° to the parting line require draft to enable the piece to be removed from the die. Outside walls normally require about one-half the taper of inner walls. A good rule to follow is that for a depth up to one inch a draft angle of 1° to 2° per side is necessary on inner walls. Lesser amounts are necessary for over one inch and zinc alloy castings normally require less taper than those of aluminum alloy. If the necessary draft is over the tolerance limit there is very little that can be done about it from a die construction standpoint. Rather it will be necessary to leave machining stock on the piece and a secondary operation will be needed to produce the desired results. Once again this results in a higher piece price.

Draft requirements in cored holes follows the same procedure as that outlined for inner walls above. Tolerances can be stated to include the allowable draft or one end of the hold may have the nominal size and tolerance placed upon it and a note as to allowable taper either plus or minus applied from this point. Again too small a limitation requires the leaving of machining stock and a machining operation to bring to size. This again, results in a higher piece price although here a secondary operation is cheaper than any attempt to cast the hole straight or nearly so.

There is a secondary consideration so far as cored holes are concerned. This is the hole diameter to maximum depth ratio. This ratio will vary due to both hole diameter and alloy. In zinc the ratio varies from 1:3 for a ¼" diameter hole to 1:6 for a one inch diameter or greater. Here the running of production is the limiting factor. Small, deep holes require long, thin cores which have a tendency to bend or break due to casting shrinkage. When bending takes place hole alignment is thrown off or hole centers become out of tolerance. When core breakage results production must cease for replacement

continued on page 50

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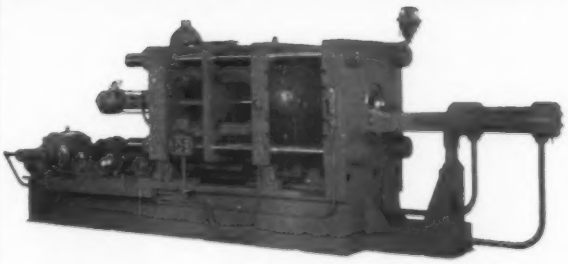

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Design Properties Of Sinterings

Part II — Ferrous alloys

Last month we presented data on non-ferrous alloys which can be used by the designer for the calculation of stresses in powdered metal parts. This month, these data are given for ferrous sinterings.

While the material given in the following three pages can never replace consultation with a reliable fabricator of sinterings, it serves as a firm basis for initial design and calculation.

In many cases the data are incomplete since not enough experience has been gained to allow a good correlation between test bar properties and the mechanical properties of sintered parts. Some compositions are more sensitive to small changes in physical properties than are others. This variation in mechanical properties is most noticeable in sinterings of relatively low density.

In many cases the initial design is best followed by machining the part from a slug of metal of the presumed composition and heat-treatment. When this scheme is employed the machined part will usually have lower mechanical properties than a sintering molded to final shape.

In those cases where a sintered part is used for its electrical, magnetic, expansion or similar property the only safe way to design is to rely on the experience of the fabricator. Here again, very small changes in processing can make relatively large changes in physical properties.

The fabricators who have contributed to these data are listed below. The number refers to the code number given in the tables. Wherever possible corresponding ASTM, SAE or AISI alloy designations are given.

1. Arrow Sintered Products Co.
2. Brockway Pressed Metals, Inc.
3. The Bunting Brass and Bronze Co.
4. Ceromet, Inc.
5. Dixon Sintaloy, Inc.
6. The Ford Motor Co.
7. International Powder Metallurgy Co.
8. Keystone Carbon Co.
9. Kwikset Powdered Metal Products
10. Norwalk Powdered Metals, Inc.
11. P. R. Mallory & Co.
12. Pacific Sintered Metals Co.
13. Powdercraft Corp.
14. The Presmet Corp.
15. Pyroferric Co., Inc.
16. The United States Graphite Co.
17. Globe Supermet

Ferrous Base

TYPICAL PROPERTIES OF SINTERINGS FOR DESIGN USE

Manufacturer				Composition; Percentages of:							Mechanical				
Code	Designation	ASTM	SAE	Fe	Cu	C Total	C Comb.	Al	Si	Other	Density grams per cc	Ultimate Tensile PSI	Elongation in percent*	Rockwell Hardness	Yield in Comps.*
1	AF-1000			100				3			5.8-6.2	14-21,000	3.0-5.0	70H-40B	
1	AF-1000-C			100							5.8-6.2	25-35,000		60-62 C	
1	AF-9307			93	7						5.8-6.2	23-35,000	0.5-2.5	20-65 B	
1	AF-9901			99		1					5.8-6.2	20-30,000	0.5-3.0	20-50 B	
1	AF-9901-C			99		1					5.8-6.2	32-42,000		60-62 C	
1	AF-8020			80	20						7.6-8.2	65-100,000	1.0-2.0	50-100 B	
1	AF-8020-C			80	20						7.6-8.2	75-120,000		60-62 C	
2	FPS-9-1	Type I, Class A		99	1						5.9	22,000 Min	1.0	H-75	
2	FPS-9-10	Type II, Class B		90	10						5.8	30,000 Min	0.5	F-75	
2	FPG-100			89	10	1					6.0	40,000 Min	0.5	B-20	
3	Bearing Grade	B202, Type II Class B	Type 3	80	20								Bearing Stock, Consult the Manufacturer		
3	Structural	B222	Type 5	90	10								Bearing Stock, Consult the Manufacturer		
3	Bearing Grade	B202, Type II Class A	Type 2	95									Bearing Stock, Consult the Manufacturer		
3	Structural	B202, Type II Class A	Type 6	95									Bearing Stock, Consult the Manufacturer		
3	Infiltrated Iron	B303	Type 7	80	20							75,000			90,000
4	Iron with Copper										6.0-7.65				
4	Copper Infiltrates														
5	L-1004			95	4	1					5.8-6.2	23-35,000	0.5		
5	L-1007	B222-52	Type 3	92	7	1					5.8-6.5	30-45,000	0.5		
5	LT-1010 Copper Infiltrated		Type 7	74	25	1					7.2-7.9	55-95,000	0.5		
5	HDS			99		1					6.8-7.5	45-120,000	0.0-12.0		
5	HDM			100							6.4-7.4	25-45,000	2.0-8.0		
5	AS		Type 2, Class A	99 Max		1-2	.25 Max				5.1-6.1	15,500	2.0	10-25 B	
5	AS		Type 2, Class B	99 Max		1-2	.25 .60				5.1-6.1	19,000	1.0	30-40 B	
5	AS		Type 2, Class C	99 Max		1-2	.60 1.00				5.1-6.1	24,000	0.5	40-50 B	
5	AS		Type 6, Class A	99 Max		1-2	.25 Max				6.1-6.5	19,000	3.0	20-30 B	
5	AS		Type 6, Class B	99 Max		1-2	.25 .60				6.1-6.5	25,000	1.5	30-40 B	
5	AS		Type 6, Class C	99 Max		1-2	.60 1.00				6.1-6.5	30,000	0.5	40-50 B	
5	ST			99		1-2	.25 .60				6.1-6.5	19-26,000	Nil	50-90 B	
5	HT			99		1-2	1.50 Max				5.8-6.4	30-40,000	Nil	10-35 C	
6	PI-90			90	10						6.1-6.5	30,000			
6	PI-96			96.7	3		0.3				6.0 Min	28,000			
6	PI-99			99.2			0.8				6.4 Min	35-50,000		20-90 B	
6	Copper Infiltrated			83.2	16		0.8				7.1 Min	65,000		80 B	
7	FE-604			60	40						5 B	8,000			6,000
7	IC-752			70 85	15 25	60 Max					7.1-7.6	75,000			90,000
7	Fe-901			90	10						5.9	40,000			30,000
7	Fe-955			95	5						5.6	20,000			30,000
7	HTF-100			Bal		0.4 1.0					6.6	50,000			60,000
8	F-101 As sintered	B202-55T Type II, Class A1		99		1					5.7-6.1	17,000	1.5	H-71	15,000
8	F-101 As sized	B202-55T Type II, Class A1		99		1					5.7-6.1	23,000	0.5	H-80	28,000
8	F-125			95		5					5.3-5.7	18,000	0.5	H-75	25,000
8	F-208 As Sintered	B202-55T Type II, Class B		Bal	7 11						5.6-6.0	27,000	1.5	H-90	22,000

* 0.1% offset

Manufacturer				Composition; Percentages of:							Mechanical			
Code	Designation	ASTM	SAE	Fe	Cu	C Total	C Comb.	Al	Si	Other	Density grams per cc	Ultimate Tensile PSI	Elongation in percent*	Rockwell Hardness	Yield in Comps.*
8	F-200 As Sized	B222-52	Type 3	Bal	7 11						5.6-6.0	30,000	0.5	H-94	33,000
8	F-200-HD			Bal	7 11						6.0-6.4	40,000	0.5	H-95	45,000
8	Z-4-LD As Sintered	B310-56T Class A	Type 6 Class A	96.25 Min		.25 Max		.2 Max	.3 Max		5.8-6.2	13,000	1.0	H-72	13,000
8	Z4-MD As Sintered	B310-56T Class B		96.25 Min		.25 Max		.2 Max	.3 Max		6.2-6.6	19,000	3.5	H-80	13,000
8	Z4-MD As Sized	B310-56T Class B		96.25 Min		.25 Max		.2 Max	.3 Max		6.2-6.6	24,000	2.5	B-16	30,000
8	Z4-MHD			96.25 Min		.25 Max		.2 Max	.3 Max		6.7-7.0	34,000	2.6	B-14	46,000
8	Z-23 Alloy Copper-Steel			94 Min	1.0 4.0						6.2-6.6	60,000	1.0	B-56	56,000
8	Z-24-MHD	B309-56T Class A		97.9 Min		.15 Max		.15 Max	.2 Max		6.9-7.29	30,000	7.0	B-50	25,000
8	Z-2 Alloy Steel			Bal		.30			.25	Ni-1.7 Mn-0.5 Mo-2.5	7.3 Min	130,000	1.5	C-30 Min C-55 Min Micro	96,000
8	Z-12			Bal		.30			.25	Ni-1.7 Mn-0.5 Mo-2.5	6.7-7.1	70,000	0.5	C-25 C-55 Min Micro	65,000
8	T-6 #302 Stainless			Bal						Cr-18.0 N-8.0	6.2 Min	50,000	7.0	B-55	35,000
8	T-4 #316 Stainless			Bal						Cr-17.0 Mo-2.5 N-11.0	6.2 Min	50,000	7.0	B-55	35,000
9	K-1100			99							6.1-6.9	16-24,000	5.0-7.0	H-70-90	
9	K-1300-A			99+							6.2-6.9	13-23,000	5.0-8.0	H-37-89	
9	K-1300-R			99+							7.1-7.6	29-42,000	17.0-35.0	E-38-72	
9	K-1400-A			99+							6.3-7.3	13,100 25,700	6.0-12.0	H-44-84	
9	K-1400-R			99+							7.15-7.7	30-42,000	21.0-35.0	H-75-96	
9	K-1104			99+		1					6.11-6.69	26-34,000	2.0-3.0	E-47-87	
9	K-2130			91	8						6.11-6.67	38-53,000	2.0-3.0	K-39-66	
9	K-2134			90	8	1					6.19-6.88	58-85,000	1.0-2.0	K-71-95	
9	K-3110			80	15					Zn 5	7.3-8.04	59-62,000	10.0-14.0	K-70-81	
9	K-3114			79	15	1				Zn 5	7.3-8.04	73-84,000	1.0-3.0	K-8597	
9	K-200-A									Ni 99	6.7-7.7	18-27,000	6.6-8.6	H-36-87	
10				100							5.5-7.5	15-40,000		F-5 to C-50	
10				Bal							5.5-7.5	15-40,000		F-8 to C-50	
10				Bal	5						5.5-7.5	20-60,000		F-8 to C-40	
10				Bal	5	1					5.5-7.6	20-70,000		to C-40	
10				Bal	8						5.5-7.7	20-65,000		to C-35	
10	Copper Infiltrated			Bal	20						6.0-8.3	40-100,000		to B-90	
12	M-204			100							7.2	34,000	23.0	B-58	
12	M-211			92	8						6.4	42,000	3.0	K-57	
12	M-213			92	8						6.7	58,000	4.0	B-64	
12	M-212			76	24						7.8	60,000	12.0	B-75	
12	M-221 Steel			91	8	1					6.4	70,000	2.0	K-82	
12	M-222 Steel			75	24	1					6.4	85,000	2.0	K-95	
12	M-205			100							7.2	110,000	4.0	C-35	
11	100 As Sintered			Bal						Mn-1 Ni-1	7.5-7.6	50-55,000	30.0-20.0	53-55	
11	101 As Sintered			Bal						Mn-1 Ni-9	7.5-7.6	78-82,000	12.0-8.0	88-90	
11	302 As Sintered					Stainless Steel #302					7.4-7.6	75-90,000	30.0-15.0	80-90	
11	600 As Sintered			Bal	2					Ni .25	7.5-7.6	68-78,000	20.0-16.0	78-81	
11	600 Age Hard			Bal	2					Ni .25	7.5-7.6	85-90,000	7.0-3.0	92-96	

13	PC-600 Carbon Steel			98.5 99.0		1.0 1.5					6.0-6.4	28,000	2.0-3.0	40-60 Brinell	
13	PC-601 Magnetic Iron			99.5							6.8	18,000	3.0-4.0	20 Brinell	
13	PC-627 Copper Iron			89 92	7 10	0.5 2.0					5.8-6.4	35,000	1.0-2.0	60-80 Brinell	
13	PC-629 Copper Iron			77 78	18 22	0.5 1.0					6.0-6.6	37,000	3.0-4.0	50-70 Brinell	
13	PC-632 Cu Infiltrated			80 85	15 20	0.5 1.0					7.0-7.5	60,000	7.0-9.0	125-155 Brinell	
14	210 Annealed			97	2	0.8					7.0	100,000	2.5	B-75	
14	210 Hardened			97	2	0.8					7.0	150,000	Nil	A-70	
14	210 Annealed			97	2	0.8					6.5	60,000	1.5	B-60	
14	210 Hardened			97	2	0.8					6.5	87,000	Nil	A-63	
14	N-00 Annealed			97.5						Ni 2.5	7.2	36,000	15.0	B-25	
14	000 Annealed			100							6.9	30,000	7.0		
14	000 Annealed			100							7.3	37,000	11.0		
14	310 Annealed			96	3	0.8					6.0	40,000	1.0	B-50	
14	705 Annealed			92.5	7	0.5					6.0	32,000	1.0	B-30	
14	010 Annealed			99		0.8					6.0	25,000	0.5	B-25	
14	X-000 Annealed			80	20						7.3	65,000	3.0	B-50	
14	X-010 Annealed			80	19	0.8					7.3	100,000	1.0	B-70	
16	408 **	B222-52	Type 5	86.5	7.0 11.0		0.3 Max	0.2 Max	0.3 Max		5.8-6.2	29,500 34,000	0.5-1.0	28,500 30,000	
16	411 ***	B310-56T Type I, Class A		96.25 Min			0.25 Max	0.2 Max	0.3 Max		5.7-6.1	14-17,000	1.5-3.0	10-15,000	
16	412 ***	B310-56T Type I, Class B		95.9 Min			0.25 0.60	0.2 Max	0.3 Max		5.7-6.1	17-22,000	1.0-1.5	15-20,000	
16	413 ***	B310-56T Type I, Class C		95.5 Min			0.6 1.0	0.2 Max	0.3 Max		5.7-6.1	22-26,000	0.5	20-25,000	
16	414 ***	B310-56T Type II, Class A	Type 6, Class A	96.25 Min			0.25 Max	0.2 Max	0.3 Max		6.1-6.5	17-24,000	3.0-4.0	15-18,000	
16	415 ***	B310-56T Type II, Class B	Type 6, Class B	95.9 Min			0.25 0.60	0.2 Max	0.3 Max		6.1-6.5	22-27,000	1.5-2.0	20-23,000	
16	416 ***	B310-56T Type II, Class C	Type 6, Class C	95.5 Min			0.6 1.0	0.2 Max	0.3 Max		6.1-6.5	26-35,000	0.5	25-27,000	
16	417 **	B303-55T Class A		71.25 85.00	15 25		0.25 Max	0.2 Max	0.3 Max		7.1-7.6	65,000	1.0	70,000	
16	418 **	B303-55T Class B	Type 7	70.90 84.75	15 25		0.25 0.60	0.2 Max	0.3 Max		7.1-7.6	75,000	1.0	90,000	
16	419 **	B303-55T Class C		70.50 84.40	15 25		0.6 1.0	0.2 Max	0.3 Max		7.1-7.6	100,000	0.5	120,000	
16	420 ***	B309-56T Class A		97.9 Min			0.15 Max	0.15 Max	0.2 Max	P-.05 Max S-.05 Max	6.9-7.29	30,000	7.0	25,000	
16	421 ***	B309-56T Class B		97.9 Min			0.15 Max	0.15 Max	0.2 Max	P-.05 Max S-.05 Max	7.3	37,000	11.0	30,000	
17	2000										7.4	54-59,000	4.0-8.0	B-40	
17	4000										6.8-7.3	50-95,000	0-1.0		
17	5000										7.4	53-70,000	½-7.0	15N-80	
17	7000										7.4	78-165,000	1.0-4.0	C-45 Min	

*0.1% offset
**ASTM Standards, 1955 Edition, composition and mechanical characteristics
***ASTM Standards, 1956 Supplement, composition and mechanical characteristics

For eye appeal and good marketability . . .

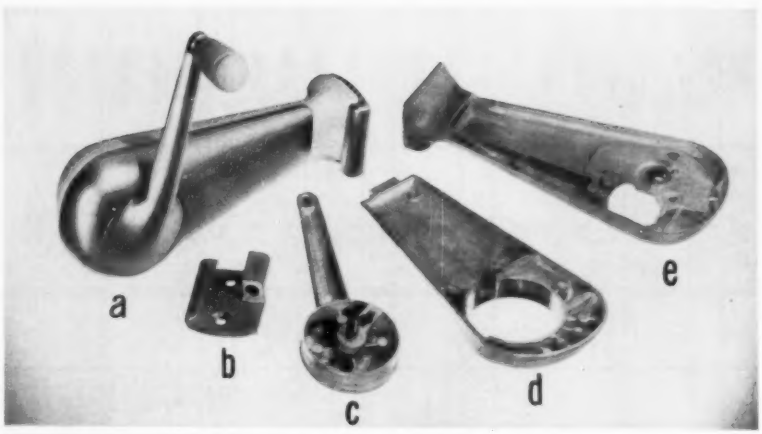
Build Your Product With Zinc Die Castings

THE Rival Manufacturing Co. uses zinc diecastings in their Can-O-Mat wall can opener because they:

- Finish well.
- Wear well.
- Are economical.

These advantages enabled Rival to market the can opener in a highly competitive field that requires style, flawless finish, and moderate cost.

The can opener, Figure 1a, utilizes four zinc diecastings in ASTM alloy AG40A: Base, Cover, Handle and Wall Bracket. These castings are about all you can see of the 49 components in the finished item.



READY FOR FINISHING these zinc die castings make up an attractive can opener.

COVER AND BASE

The base and cover are cast together in unit die at the rate of 125 shots per hour. Cored holes for the handle and assembly screw are cast in the cover, Figure 1d. Only four production steps are necessary: (1) Cast. (2) Trim and machine. (3) Tap for assembly screw. (4) Burnish and paint or plate.

The handle hole is machined with a special cutter. It is reamed to 2.067 in dia.

+.005 in.
—.000 in.

The cast step-in-hole, which retains the flange on the handle, is reamed to 2.145 in dia.

+.000 in.
—.005 in.

The hole for the assembly screw is cored to .110 in. dia. maximum, .103 in. dia. minimum by 31/64 in. deep. It is then countersunk 5/32 in. by 90 degrees and is tapped to 3/8 in. full thread.

The base, Figure 1e, is cast with a recess cored to .126 in dia. +.200 in., —.000 in., .100 in. deep (.063 in. spherical radius). Production steps for the base are: (1) Cast. (2) Trim. (3) Drill and tap magnetic steel attachment hole. (4) Press in steel bracket pin. (5) Face rear section. (6) Insert ball bearing into cored recess and stake. (7) Spot face flash around insert bushing. (8) Burnish and paint or plate.

The cover is assembled to the base. Flash lines are ground to match for flush fit. This fit is accurate so ground parts can be interchanged. Parts having parting lines, cracks or marks are not used in the finished product.

HANDLE

The handle, Figure 1c, is cast with an hexagonal steel insert, which serves as a drive shaft, and it is cored for an intricate recess to accommodate a pawl. The handle needs only trimming and is then finished the same as the cover and base: burnished, then painted or plated. The handles are made in 2-cavity dies at a rate of 125 shots an hour.

WALL MOUNTING FLANGE

The wall mounting flange, Figure 1b, must match the base flange with sufficient precision to limit lateral and/or vertical shifting to less than .005 in. Zinc diecastings meet this requirement.

WALL BRACKET

Production time and cost were reduced by zinc diecasting the wall bracket, which is used on other of the company's products too. They're made in a 12-cavity die at a rate of 125 shots per hour. Production steps are: (1) Cast. (2) Trim. (3) Countersink cored screw holes. (4) Tumble. (5) Chrome plate.

To make the bracket any other way would take more tooling and operations than diecasting.

By using zinc die castings in the can opener, the company was able to hold close dimensional tolerances throughout. Also, the use of zinc die castings assured a quality finish, whether by paint, chrome or copper plating.

HIGH TEMPERATURE, HIGH STRENGTH alloys are investment cast by International Nickel Co. They operate at 1500°F in aircraft equipment built by Bendix Aviation.

Coming!! 3400°F Alloys

JET aircraft and missles aren't the only uses for turbine wheels, investment cast in high strength, high temperature alloys. Less glamorous, but eventually more important industrially are the turbine wheels used in gas turbines and superchargers for both stationary and mobile power units.

The gas turbine for passenger automobile use may be many years away. The gas turbine for industrial use and for heavy prime movers such as locomotives and on ships is with us now.

More widespread use of these investment cast components waits on higher thermal efficiencies. The increase can best be secured by increasing the operating temperature. At present the highest temperature in industrial gas turbines is about 1500°F. This is up 100°F over five years ago, it should rise at least 125°F more in the next five years. The importance of such a small increase in operating temperature is a 6% jump in output for each 50°F rise, plus lower fuel costs per horsepower output.

No one can predict what metals or alloys will give the desired increase in operating temperatures. Certainly molybdenum or molybdenum base alloys will be important. Tungsten may also play a part.

Two basic technologies may have to be developed to a much higher degree than they are at present. One, the melting and casting of the so-called "exotic" metals in either vacuum or in a protective atmosphere. The other the cladding of easily oxidized metals with a nonmetallic coating.

The relative abundance of molybdenum in this country makes it look like the more promising metal of the future, certainly it is going to be of great importance.

An emperical formula which relates the maximum probable working temperature to the melting point of metals and alloys has been developed by C. M. Brown and R. W. Fountain in the Niagara Falls laboratories of the Electro Metallurgical Co. This formula predicts:

Titanium base alloys will be useful in the range up to 1600°F.

Columbium base alloys may be worked up to 2500°F.

Molybdenum and molybdenum base alloys should find use up to 2600°F.

Tungsten base materials indicate working temperatures near 3400°F.

All of these materials are difficult to fabricate and expensive to machine. Investment casting will probably be the only fabricating method which can make parts with reasonable economy.

Machining Of Cobalt Superalloys

SUPERALLOYS containing cobalt are not difficult to machine if proper methods are used. Table I lists 21 of these alloys. High quality machine tools, sharp cutting tools of proper design and material, low speeds and feeds, a continuous cutting action, and intimate cooling are the minimum requirements for success.

Superalloys exhibit solid-solution-type microstructures with possible segregations of visible and submicroscopic intermetallics. Above 2100°F these constituents dissolve, they form a simple solid solution. The solid solution is retained after quenching, but is unstable. On aging the insoluble constituents precipitate at varying rates. The rates depend on the alloy and the temperature of aging.

INCONEL — 713-C turbine blade, investment cast by International Nickel Co.

Some alloys are machined in the solution-treated condition. Others in the partially aged condition and some when fully aged. The aged alloys, though hardest, often machine the easiest because of lower work-hardening tendencies.

These alloys work harden like the austenitic stainless steels. Many of the machining techniques used with austenitic stainless steels work with the superalloys.

Cutting tools must have smooth tool-chip contact areas, sharp cutting edges, and must be free of feather edges. Tools should be strong and rigidly mounted with a minimum of overhang. For the lowest cutting temperatures, feeds and speeds lower than those used with austenitic stainless must be used. To prevent burnishing and glazing, use a good depth of cut and always be sure that the tool is cutting when in contact with the work. Avoid second cuts and finishing cuts if possible. The cutting fluid should give good cooling, carbon dioxide coolant has been used with some success.

MACHINING OPERATIONS

DRILLING

Drilling is the most difficult machining operation on superalloys. The tip of the drill constantly rubs against the bottom of the hole causing work-hardening. A positive feed is essential, and the drill must be kept sharp. Deep holes may require one or two resharpenings of the drill. The hole wall will work harden to some degree. Therefore, pilot drills are not practical since

TABLE I
Chemical Compositions of Cobalt Superalloys(a)

Alloy	Nominal Chemical Composition, per cent										Type
	C	Co	Ni	Cr	W	Mo	Cb/Ta	Ti	Al	FE	
Therlo; Rodar; Kovar A		17	29							54	Iron base
G. 188	0.40	10	13	13	2.5	2.0	3	—	—	56	
K-42-B	0.05	22	43	18	—	—	—	2.5	0.2	13	
Refractaloy 26	0.05	20	37	18		3		2.8	0.2	18	
Refractaloy 70	0.05	30	20	20	4	8				15	
Refractaloy 80	0.10	30	20	20	5	10				14	
N-155	0.15	20	20	21	2.5	3	1			32.5	
S-590	0.43	20	20	20.5	4	4	4			27.5	
Konal		17	72					2.2		6.25	
Nimonic 90	0.10	20	51	20				2	1	5	
Inconel 700	0.13	29	46	15		3		2.2	3.2	0.8	Nickel base
Udimet 500	0.08	19.5	47	19		4		2.9	2.9	4	
M-252	0.15	10	55	19		10		2.5	1.0	2	
Haynes Alloy 25	0.15	51	10	20	15						
J-1570	0.20	38	28	20	7			4		2	
S-816	0.38	40	20	20	4	4	4			4	
G. 34	0.8	45	12	19		2	1.3			20	
HS-21	0.25	62	3	27		5					Cobalt base
X40; Haynes Stellite 31	0.5	55	10	25	8					1.5	
Cobenium; Elgiloy	0.15	40	15	20		7	Mn 2			16	
Rexalloy 33	2.25	44		33	11					2.0	

(a) Arranged approximately in the order of decreased machinability.

the drill opening the hole may break.

TURNING AND FACING

Turning and facing operations are the easiest of machining operations to accomplish. High-speed steel, nonferrous cast alloy, and carbide tools are used. For intermittent cuts high-vanadium high-speed steel and reduced speeds should be used. Cutting tools should be replaced before they become dull. Work should be rigidly supported and a positive feed should be maintained during cutting. The tool should never ride on the work without cutting. When finishing cuts are necessary, the depth of cut should be below the work-hardened surface left by the roughing operation. Stress relieving is sometimes required after roughing operations.

Recommended operating data have been developed. Cutting speeds, higher than those are sometimes used, and shorter tool life is accepted to obtain a reasonable production rate. When turning scaled work, lower cutting speeds should be used. Feed rates below 0.0035 ipr tend to burnish.

MILLING, BROACHING, REAMING, SHAPING

There are only limited data available on milling, broaching, reaming, and shaping operations for some alloys. These data which also can be used as a guide for the superalloys not listed. Special surface treatments may improve the lives of mills, broaches, and reamers.

TAPPING

Superalloys are usually tapped in the solution-treated condition. Three-flute, high-speed steel gun taps have been used and seem superior to the four-flute types. The hook angle should be somewhat greater than that used for tapping the more common metals. Special surface treatments applied to taps increase resistance to abrasion. Hand tapping is used, rotating the tap half a revolution before reversing. A sulfochlorinated type of oil is applied with a brush.

CUTOFF

Friction saws and rubber-bonded cutoff wheels will cut superalloys satisfactorily. Conventional high-speed saws are not suitable.

UNUSUAL MACHINING METHODS

There are two unusual metal removal methods which may be applicable to superalloys; hot machining, and the electric discharge method. The use of heated workpiece for machining operations on some other metals has met with excellent success. The electric discharge method removes metal by spark erosion without physical contact between work and tool. A liquid medium flushes away the erosion products from the work-tool reaction site. Strain hardening is therefore avoided because distortion and strain produced by normal cutting tools during machining do not occur. Chemical milling, although successful on aluminum, awaits the development of a proper dissolving medium for superalloys.

This article is a condensation of a paper released by the Cobalt Information Center. Copies of the full paper can be secured from the Cobalt Information Center, c/o Battelle Memorial Institute 505 King Ave., Columbus 1, Ohio.

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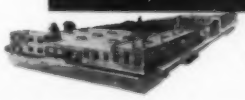

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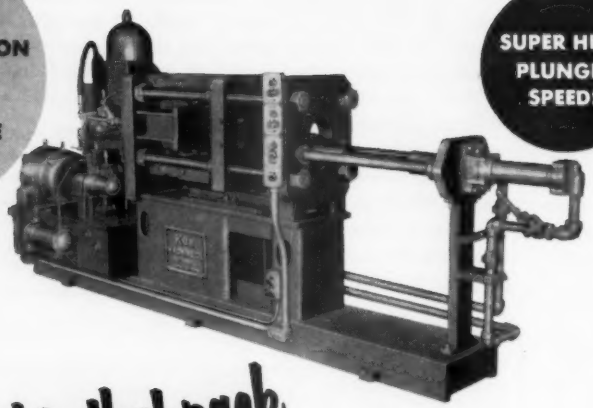

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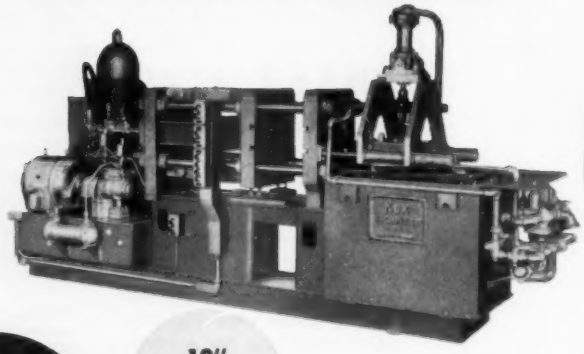

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Design Tips

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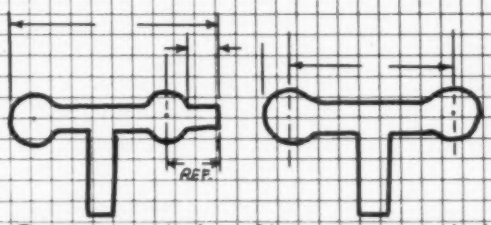
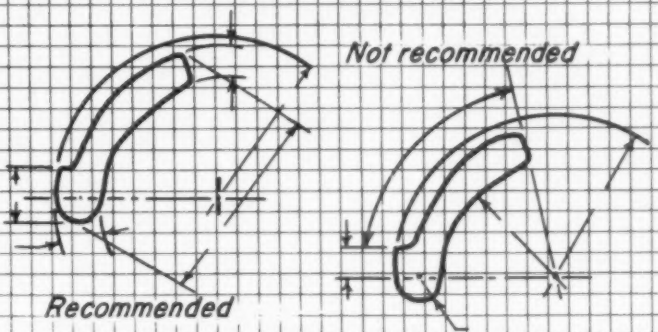


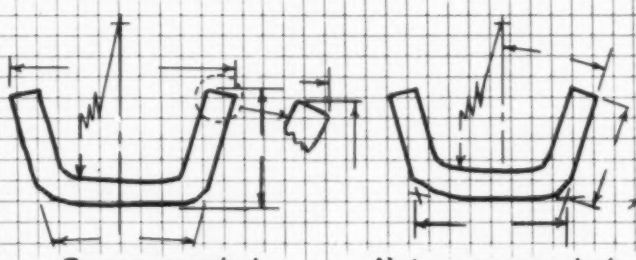
Recommended *Not recommended*

Overall and offset dimensions are prefered to centerline dimensions. Give enough dimensions for shape construction and to insure inspection from positive points. Center points are imaginary.



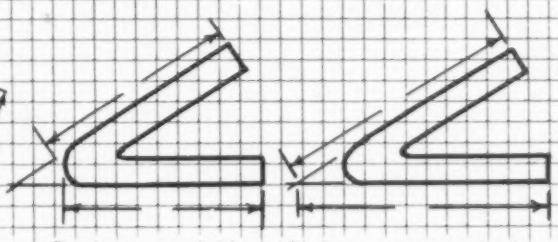
Recommended

The recommended dimensioning shows chord length, metal thickness and step lengths. Radii and arc lengths are hard to check accurately.



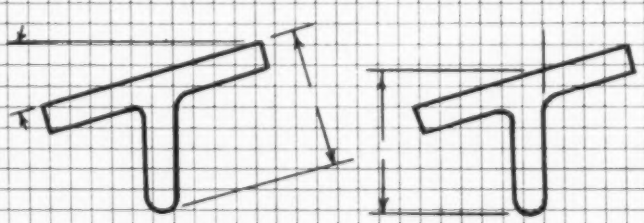
Recommended *Not recommended*

Dimensions must be given that positively define the shape. Show dimensions tangent to the part, not to an ill defined intersection of extended lines.



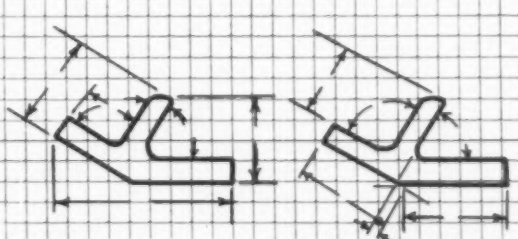
Recommended *Not recommended*

Use positive metal lengths to define a part. Where the intersection of lines is extended to an imaginary point of intersection there is chance of considerable error both in die making and in checking.



Recommended *Not recommended*

Specify dimensions perpendicular to at least one flat surface whenever possible. The shape is not controlled by other dimensions and inspection requires special gauges.



Recommended *Not recommended*

Dimensioning to a sharp corner, instead of a flat surface leads to errors. A sharp corner can not be extruded. Dimensions need only define the shape.

Courtesy: Revere Copper & Brass, Inc.

PMM DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards on the facing page will get you these free reference materials. Circle the numbers and mail.

1. **Casting Supplies** — Detailed information is available on Refrax Pots that retain heat, have less swelling and distortion, and are tough and durable. ACF Industries.

2. **Melting Furnaces**—Technical information is available on the 60-cycle induction melting furnaces of the Ajax Engineering Corp. Ranging in size from 20 kw to 2000 kw, the furnaces will produce from 150 pounds per hour to 40 tons per hour.

3. **Publications List**—which gives full data on the more than 125 technical publications offered by the company, is available from Allegheny Ludlum Steel Corporation.

7. **Die Casting Trim Presses**—and die casting machines, that will meet your exacting requirements, are described in literature from B & T Machinery Company.

10. **Minicast Process** — This process which combines the advantages of investment casting with such precision methods as coining, cold forming, etc., is described in a brochure from Casting Engineers Incorporated.

12. **Seven Models** — of hydraulic die casting machines are described in literature from The Cleveland Automatic Machine Co. Includes complete machine specifications and quotations.

14. **Standardized Die Components** — which reduce design time and cut die construction costs, are described in a 170 page catalog published by The Detroit Mold Engineering Co.

15. **Universal Tester**—for testing tensile, transverse, compression and shear is described in brochures from W. C. Dillon & Co., Inc. The unit will handle round, flat or special shapes.

21. **Metal Working Lubricants** — Fiske Brothers Refining Co. offers bulletins describing their 514A Hot Die Lubricant and other specialty lubricants.

22. **Small Parts Problem?**—A solution might be found in informative bulletins issued by Gries Reproducer Corp. The subjects are zinc alloy die castings, injection molded plastics, and low-cost fasteners.

23. **Zinc Die Casting Facts** — Henning Bros. & Smith, Inc. has issued a booklet entitled "Die Casting with Zinc Base Alloys", explains the factors influencing production of sound castings and the causes of faults and defects.

24. **Sintering Furnaces**—for controlled atmosphere or vacuum sintering are described in bulletins 357 and 557 from the Hevi-Duty Electric Furnace Co. Technical information is provided to help determine the best furnace for individual sintering requirements.

26. **Die Casting Machines** — Bulletin 5400-A, from The Hydraulic Press Mfg. Co., describes a line of die casting machines that feature more weight, horsepower, speed, flexibility and savings.

27. **Sand Additive**—Petro Bond, a sand additive for precision casting, assures higher quality finish in brass and bronze castings according to a booklet from the Baroid Div., National Lead Co.

Die Casting—"Latrobe Castings" tells the story of the Latrobe reputation for workmanship, service and economy on both small and large quantity production runs. A copy of this booklet may be obtained by writing on company letterhead to: Latrobe Die Casting Co., Latrobe, Penna.

30. **Die Casting Machines**—Two new hydraulically operated casting machines are described in a catalog issued by Kux Machine Co.

31. **Wax Injectors**—Complete specifications and features of three models of all-hydraulic wax injection machines are available from Leyden Hydraulics, Inc.

33. **Die Casting Machines**—Information on a complete line of die casting machines is available from Lester-Phoenix, Inc. The units feature reliable clamping, and are readily adapted to vacuum casting.

34. **Die Castings** — Literature and design information is available from Litemetal Dicast, Inc. on the company's die casting equipment for producing parts of any size.

43. **Plaster Mold Castings** — How you can produce your small parts to the most exacting tolerances, for just a few parts or a production run, is discussed in an illustrated brochure from Ohio Precision Castings, Inc.

45. **Sinterings**—"How to Cut Precision Parts Cost with the Remet Powdered Metal Process" is the title of a brochure available from Reese Metal Products Corp.

46. **Carbon Compatible Powders** — Technical data on these powders that cut costs and broaden the application of powder metallurgy, is available from Republic Steel Co.

49. **Stainless Steel Ladles & Skimmers**—which are 75% lighter than cast iron and have extremely long life, are described in literature offered by Spincraft, Inc.

51. **Investment Castings** — of magnetic alloys are being produced by Westinghouse Electric Corp. Complete details on facilities for supplying small quantities of prototype parts or production runs are available.

54. **Barrel Finishing Handbook**—Almco Queen Products Div., King-Seeley Corp., has issued a 52-page handbook of case history facts and descriptions of barrel finishing processes. Includes cost charts on finishing typical parts.

55. **Die Grinding** — Brochure describes capabilities of "Visual Grind" system in construction of precision high-production dies, dies for powder metallurgy, lamination dies and special purpose dies. Cleveland Grinding Machine Co.

56. **Multiple Spindle Heads** — for drilling or tapping on any drill press. Catalog from Ettco Tool & Machine Co., Inc. lists fixed spindle, geared adjustable, and Knuckle-Head adjustable heads.

57. **Corrosion Resistance** — Excellent paint durability, low operating costs, and low labor costs; these are the features of Phosteem as described in Bulletin 55-137. Neilson Chemical Co.

59. **Electrocleaner**—for zinc die castings that assures a brighter plate and cuts rejects, is described in literature from Oakite Products, Inc.

61. **Vertical Diecaster** — that features automatic cycling control, central feed with high injection force, and has a locking force of 110 tons on Model V-100, and 330 tons on Model V-300, is described in technical literature from Buhler Brothers, Inc.

64. **Hydraulic Compacting Presses** — in capacities from 2 to 75 tons, feature an exclusive shuttle-feed with rotary agitator for compacting powdered metal parts. Bulletin M-11-B from Denison Engineering Div., American Brake Shoe Co.

66. **Investment Casting**—An illustrated brochure from Hitchiner Mfg. Co. presents information on how you can utilize the freedom and savings offered with Investment Casting.

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- ☐ Permanent Mold Castings
- ☐ Plaster Mold Castings
- ☐ Shell Mold Castings
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4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306

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3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306

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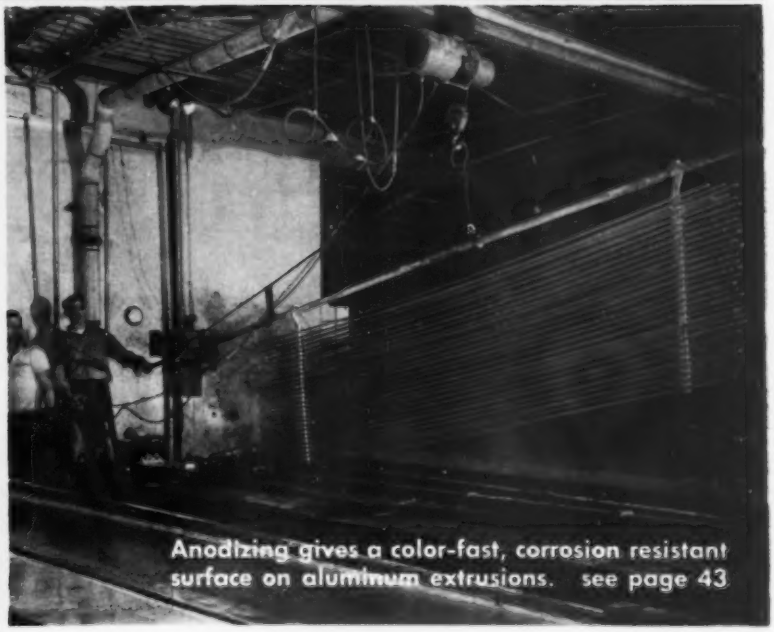
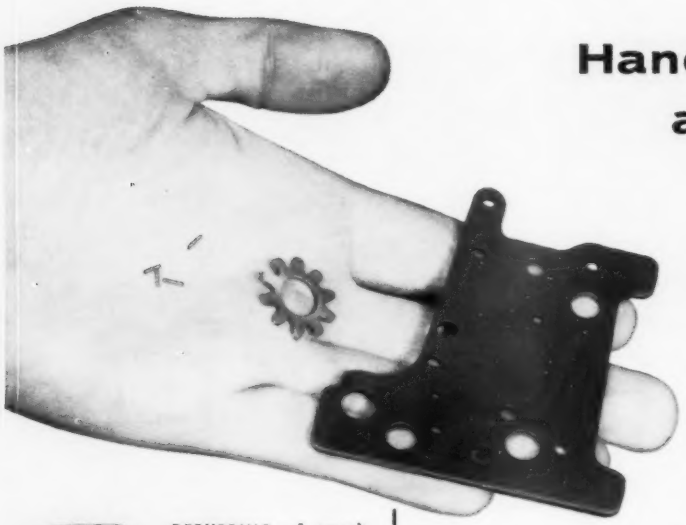
PMM Finishing Section

The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.



Anodizing gives a color-fast, corrosion resistant surface on aluminum extrusions. see page 43



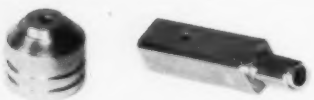
Hand Your Deburring and Finishing Problems to ALMCO...

These companies did... and cut costs, improved quality, increased production.

DEBURRING of spark plug bushings by hand formerly caused many rejects at Canadian Pratt and Whitney. Costs were $104.20 per M with rejects totalling 12½%. Two Almco barrel finishing machines cut costs 97%, practically eliminated rejects.

SMALL GREASE GUN COUPLER JAWS (½" x ¾") couldn't be deburred manually at a midwest screw products firm. With an Almco barrel finishing machine, 40,000 coupler jaws can now be deburred in 10 hours. Jaws are smooth, uniform, ready for plating.

DEBURRING AND POLISHING by manual methods proved expensive for delicate instrument and fountain pen parts at J. Bishop & Co. Almco barrel finishing machine increased output from 200 to 6000 parts per hour, cut costs 98.8%. Annual savings: $6,917.50.



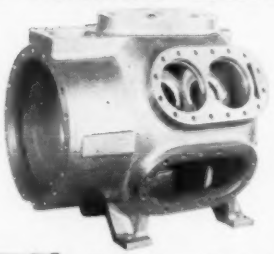
INCREASED PRODUCTION quotas demanded faster finishing at Alco Valve Co. Hand deburring and polishing finished only 200 stainless steel parts per hour. Almco machines are now barrel finishing over 1400 per hour, and to stricter finishing specs. Plant production needs are easily filled.

FILING burrs by hand formerly cost $55 per 100 needle plate forgings at Landis Machine Co. Now an Almco barrel finishing machine has cut finishing costs to 55 cents per 100 parts. Parts are uniform, rejects are eliminated. Savings come to 99%!

HEAVY WORK LOADS of roller bearings presented serious finishing problems at Timken's Columbus, Ohio plant. Now special heavy-duty Almco barrel finishing machines are processing two tons of rollers per load. And 50% of floor space has been saved, finishing costs have been slashed.

Large Parts too are Almco Barrel Finished!

AT AN IOWA FOUNDRY, an Almco barrel finishing machine deburrs, polishes 48 large wash machine agitators per hour. Fixtures hold castings firmly within Almco barrel. Rough edges are completely removed; castings are highly polished; appearance is improved.



AT AIR CONDITIONING FIRM, compressor housings weighing over 100 lbs. are Almco barrel finished. Almco process breaks sharp edges of castings, cleans internal surfaces, and improves surface finishes. Two housings are cleaned in 20 minute cycle! Workmen are relieved for other plant tasks!

Send Your Parts to Almco's Modern Test Laboratory.

Sample parts processed without obligation. Simply write on letterhead, sending parts direct to Albert Lea, enclosing specifications required. Complete, *free* report includes recommendation. 52 PAGE HANDBOOK ON BARREL FINISHING SENT ON REQUEST.

ALMCO

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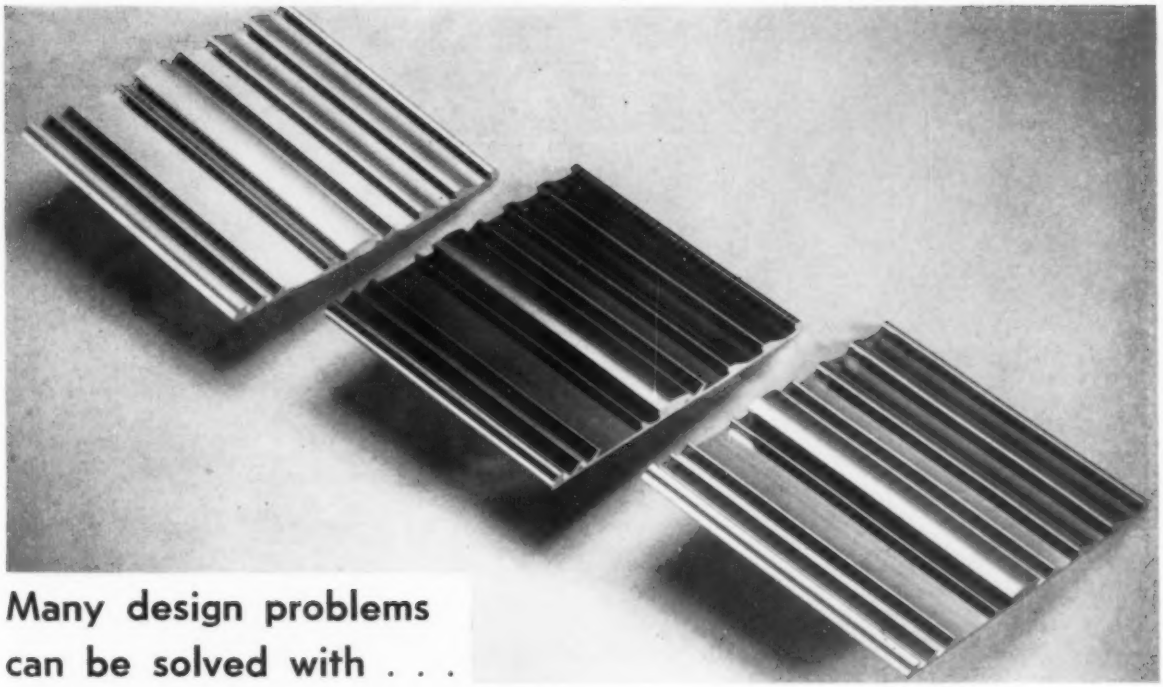


Many design problems can be solved with . . .

Anodized Aluminum Extrusions

BY FRED G. SHULER*

ANODIZED aluminum has opened new doors for the design engineer. Its uses range from replacing stainless steel on automobiles to shapes which end up as chalk trays for blackboards in school rooms. There are thousands of other applications already in use and just as many yet to be devised. All that's required is a basic knowledge of what is available, what can de done, and a bit of imagination.

Anodizing is an electrochemical way to produce an extremely hard and durable surface of aluminum oxide on an aluminum base alloy. This oxide film can be dyed almost any desired color. When organic dyes are used the colors may not be stable, they may fade after exposure to sunlight, but colorfast surfaces can be made with mineral pigments.

Anodized aluminum is very practical. No other protection is necessary for good corrosion protection. It requires no maintenance. It can be used indoors or outdoors and is ideal for such things as autos, store fronts, awnings, doorways, etc. The worst industrial atmospheres and salt spray will not harm an anodized surface. It's a fine base for paint. Use anodizing right and you'll lower fabrication costs, add long life to your product and cut maintenance costs to zero.

There are many ways to apply anodic coatings. Here at General Extrusions, Inc. we use the sulfuric acid method. Our regular commercial coating is a porous oxide film of varying color depending on the alloy anodized. Its thickness ranges from 0.001" to 0.002". Thickness, color, porosity and hardness can all be varied by changes in time in the acid bath and the current density used. The regular commercial coating makes a corrosion and abrasion resistant base for paint and an excellent carrier for dyes. This is how we put it on:
1. Hot (180°F to 190°F) alkaline cleaner. 2. Cold water rinse. 3. Make the extruded shape the anode in a 12% to 16% solution of sulfuric acid (the electrolyte) at 65°F to 90°F., use from 15 to 20 volts direct current for 15 to 20 minutes. 4. Cold water rinse. 5. How water (190°F to 200°F) seal for 5 to 10 minutes. 6. Air dry.

This process is suitable for all aluminum alloys, but should not be used on assembled parts where there is danger that acid might be trapped, entrapped acid would encourage corrosion.

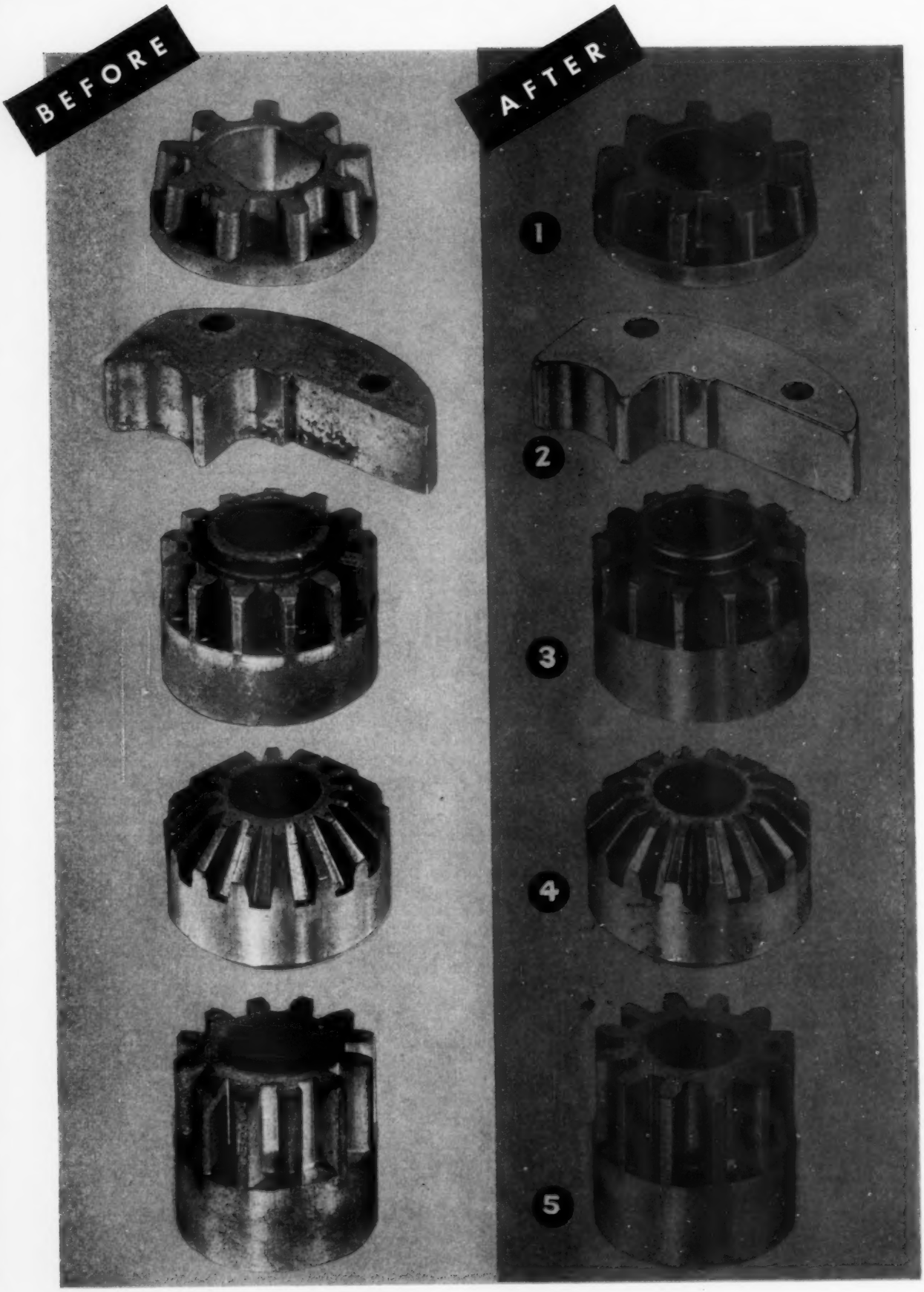
The best finish and colors are with these alloys: 1100, 3003, 6053, 6061, 6062, 6063, and 6463. Of these alloys, 6063 and 6463 are the most widely used; 6463 probably gives the brightest finish of all.

If we add two more operations, one of which is a color tank and the other a cold water rinse between steps 4 and 5, we can get almost any desired color. For inside or outside use red, blue, green, black, yellow and gold are available in our own plant.

To get an exceptionally bright finish, an extruded shape should have a broken surface. By this, I mean broken by longitudinal lines,

continued on page 48

*PRESIDENT, GENERAL EXTRUSIONS, INC.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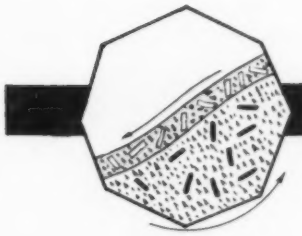

BARREL FINISHING

How To Finish Sinterings In A Barrel

TABLE I

Processing Data For Parts Illustrated

Fig. No.	Cycle time in hours	No. parts per load	Processing per M dollars	Cost per piece cents	Operations Performed				
					Surface Finish	Deburr	Clean	Rust inhibit	Radius
1	4	5000	0.70	0.0007		X	X	X	
2	8	4000	1.67	0.0017	X			X	
3	3	930	3.10	0.0030	X		X		X
4	3	2100	1.37	0.0014	X		X		X
5	2	975	2.15	0.0020				X	X

Processing data for all parts. Medium speed of barrel rotation, 250 lbs. of parts, 2 pounds compound, 10 gallons water, 800 lbs. of special chips. Standard barrel finishing machine used for all parts, no fixturing.

IT just doesn't make sense to save money by using sinterings and then throw it away on surface finishing operations. And what's even more to the point; many companies could use sinterings and show a nice cost saving if they could mass finish them. Up to now they couldn't.

Now mass finishing of production runs is possible. The Roto-Finish Co. has been finishing a variety of sinterings in large quantities and at consistently low costs ranging from 0.0007¢ to 0.003¢ per part.

How was it done – by pretty standard barrel finishing methods. The secret is in the choice of media and compound.

Special processes and materials have been developed for the finishing of sinterings. Because powdered metal parts are generally less dense than wrought metal parts, care and know-how are needed to apply the correct methods of barrel finishing. For example, barrel finishing as wrought steel part requires a compound containing a harsh abrasive to deburr the work pieces and provide a good surface.

To use the same compound on a sintering could easily result in deep surface scratches and destroy the dimensional accuracy of the part. Also, the abrasive can impregnate the porous structure of the part. Where a wear surface is involved, such as bearings, gears, cams, followers, etc. impregnation with a hard, harsh abrasive would be ruinous. Rejects and damaged equipment would quickly eliminate any savings.

A steel sintering requires a compound with a fine, soft abrasive—or no abrasive at all—to provide the proper finish.

Because sinterings are generally less dense than wrought parts the finishing cycle is short and it's easy to over-process. But, with proper control tolerances and dimensions can be held and a fine finish achieved.

The illustration shows a few parts that have been successfully barrel finished. The vital statistics are given in Table I. All of them are sinterings and all represent a very large saving in finishing operations.

Not all sinterings can be processed loose. Very delicate parts or parts too large can be fixtured in the usual manner. This eliminates damage due to impingement.

When the parts are quite large a spindle type machine may be best. This machine has a rotating spindle on which the parts are fixtured. This assembly is lowered into a media and compound mass in a circular tub which revolves at variable speeds. Parts can be finished in ½ to 2 minute cycles and as many as 400 parts per hour have been run.

Special compounds are available for sinterings. For powdered iron parts the compounds also contain lubricant and rust inhibitor. Special compounds have also been developed for non-ferrous parts and for infiltrated sinterings.

PROPERTIES OF EXTRUDED ALLOYS

TABLE IV

Typical Tensile Properties of Some Aluminum Alloys at Elevated Temperatures

Alloy and Temper	Property	75°F	300°F	400°F	500°F	600°F	700°F
3003-H14	Ultimate Strength (psi)	21,500	17,500	14,000	10,000	5,000	3,000
	Yield Strength (psi)	19,000	12,500	8,000	4,000	2,500	2,000
	Elongation % in 2 in.	16	17	22	25	40	60
2014-T6	Ultimate Strength (psi)	70,000	47,000	18,000	11,000	6,500	4,500
	Yield Strength (psi)	60,000	40,000	12,000	8,500	5,000	3,500
	Elongation % in 2 in.	13	15	35	45	65	70
2017-T4	Ultimate Strength (psi)	62,000	40,000	22,000	12,000	6,500	4,500
	Yield Strength (psi)	40,000	30,000	17,000	9,500	5,000	3,500
	Elongation % in 2 in.	22	16	28	45	95	100
2024-T4	Ultimate Strength (psi)	68,000	43,000	26,000	14,000	7,000	5,000
	Yield Strength (psi)	48,000	37,000	22,000	10,000	5,000	3,500
	Elongation % in 2 in.	19	17	22	45	75	100
6061-T6	Ultimate Strength (psi)	45,000	32,000	19,000	7,000	4,000	3,000
	Yield Strength (psi)	40,000	30,000	16,000	5,000	2,500	2,000
	Elongation % in 2 in.	17	18	25	65	90	105

(Note: This table is a continuation of the data published last month.) Data courtesy Reynolds Metal Co.

NEW VICE PRESIDENT FOR METAL FINISH, INC.

ARMSTRONG

Mr. Paul E. Kirchartz, president of METAL FINISH, INC., announced the election of William H. Armstrong to the position of vice-president and general manager. Metal Finish, Inc. is the U.S. Sales Agent for the recently developed "Vibraslide" Barrel Finishing Machine and also manufacturers of other metal finishing equipment and accessories. Mr. Armstrong has been in the barrel finishing field for over 15 years; was, prior to this appointment sales manager for the Honite Products of the Minnesota Mining and Manufacturing Co., whose products are also distributed by Metal Finish, Inc.

ABRADO FINISH CORP. EXPANDS

THE ABRADO FINISH CORP. formerly the Grand Rapids Tumbling Supply Corporation, has just completed the addition of over 10,000 square feet of new offices, experimental laboratories, and manufacturing facilities to their plant.

Several months ago the name "Abrado Finish Corp." was adopted to replace the former name used by the company since its founding in 1954 by Wallace L. Reed. "The new facilities", said Mr. Reed, "will greatly improve our customer services." "We now have a completely equipped laboratory for analyzing and finding the answers to every type of barrel finishing problem."

Mr. Reed also advised that C. Heamon Castle is associated with the Abrado Finish Corporation as executive vice-president and technical director. Mr. Castle's background includes 25 years of process development for the metal finishing trade.

FREE BROCHURE shows How You Can CONTOUR GRIND Dies for POWDER METALLURGY!

IMPORTANT TO YOU!

Free booklet tells how VISUAL GRIND facilitates construction of precision high-production dies, dies for powder metallurgy, lamination dies and special purpose dies. VISUAL GRIND permits through, blind and templet grinding . . . permits continuous inspection by magnifying work from 10:1 to 100:1 . . . upgrades semi-skilled labor . . . permits easy maintenance of dies in your own plant . . . reduces costly down time. VISUAL GRIND COMPLETES YOUR TOOL ROOM.

Visual Grind solves the problem in mind

Intricate grinding jobs like those shown above ordinarily involve several machines. ALL WERE FORM GROUND ON A SINGLE VISUAL GRIND.

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The CLEVELAND GRINDING MACHINE Co.

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now

you can get this brilliant finish directly on zinc die castings!

PART AS CAST

No electroplating—no mechanical finishing!

TREATED WITH NEW IRIDITE

NEW IRIDITE (Cast-Zinc-Brite)

brightens zinc die castings by chemical polishing, protects against corrosion

NOW, FOR THE FIRST TIME you can get a brilliant, decorative finish directly on zinc die-cast parts . . . without mechanical finishing, without electroplating! The luster is provided by the *chemical polishing* action of new Iridite (Cast-Zinc-Brite) solution. Even surface blemishes, such as cold shuts, are brightened by this new process. No electrolysis. No special equipment. No specially trained personnel. Just a simple chemical dip for a few seconds and the job is done. And, this new Iridite has been *tested and proved* in production.

CORROSION RESISTANCE, TOO! New Iridite (Cast-Zinc-Brite) provides exceptional corrosion resistance for bright-type chromate finishes . . . also guards against blueing or darkening by eliminating zinc plate formerly required in bright chromate finishing of zinc die castings.

AS A BASE FOR ELECTROPLATING—Lower mechanical finishing costs are possible where plated finishes are *required* since the brightness provided by this new Iridite may be sufficient.

LET US SHOW YOU what Iridite (Cast-Zinc-Brite) can do for you. Send us at least a half-dozen typical zinc die-cast parts for FREE PROCESSING for your own tests and evaluation. Or, for immediate information, call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified 'phone book. *IMPORTANT: when you give us samples for test processing, please be sure to identify the alloy used.*

Allied Research Products, Inc.

4004-06 EAST MONUMENT STREET
BALTIMORE 5, MARYLAND

***Manufacturers of* IRIDITE®, IRILAC™, ARP® Brighteners and Plating Chemicals—West Coast Licensee: L. H. Butcher Co.**

For more information circle No. 53 on the Reader Service Card

ANODIZING

continued from page 43

either indented or raised. They increase the reflectivity and when sulfuric acid anodizing is used the surface will reflect about 85% of the incident light.

As examples of the wide range of products that are now using anodized extruded shapes here are some for which we have made parts: Automotive trim (to replace stainless steel), refrigerator parts, office equipment, ice cream freezers, awning frames, luggage, venetian blinds, draw drape racks, store fixtures, store fronts, ornamental fixtures, shower door frames, house trailers, asphalt spreaders, signs, blackboard frames and chalk trays, nameplates, roofing and sheet metal on houses, tracks for light fixtures, dishwashers, and hardware.

The design engineer, with the product taking shape on his drawing board, will profit by considering anodized extruded aluminum. No other metal, in the long run, will better meet the need for durability, attractiveness and economy in manufacture.

As a reference for designers, here are a few of the finishes we can apply, with our own trade names for them:

Generalucent Finish—Very bright, sparkling, chromium-like mirror finish secured by buffing.

Generalite Finish—Pearl-like natural aluminum finish, especially for outdoors. Will not rub off, black or smudge.

Generalustre Finish—Bright and lustrous, produced by polishing to a high lustre, then anodizing and sealing to prevent spotting.

Generalsatin Finish—Satin finish for storm windows, doors, store fronts and general industrial applications. Secured by etching the extruded section and then anodizing. This is an excellent base for paint and will not rub off, black or smudge.

R-5 Finish—A new development similar to a chromium plated surface, but less costly to produce.

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a completely NEW concept in metal cleaning!

- An easy handling liquid.
- Effective on *all* metals.
- Requires NO special tanks or equipment.
- A completely organic product.
- Won't injure rack coatings or work finish.
- Simple positive control.

Alkalume LC-1 is a specially developed immersion-type cleaner for removal of buffing compounds and soil from all metals, prior to plating or anodizing.

It is non-solvent, non-alkaline and not an emulsion. It has the desirable penetrating properties of both alkali and solvent yet affords complete protection for the surface finish.

Alkalume LC-1 is economical, non-toxic and non-volatile, offering long service life and no disposal problem.

Complete details upon request.

The name NORTHWEST means first with the best!

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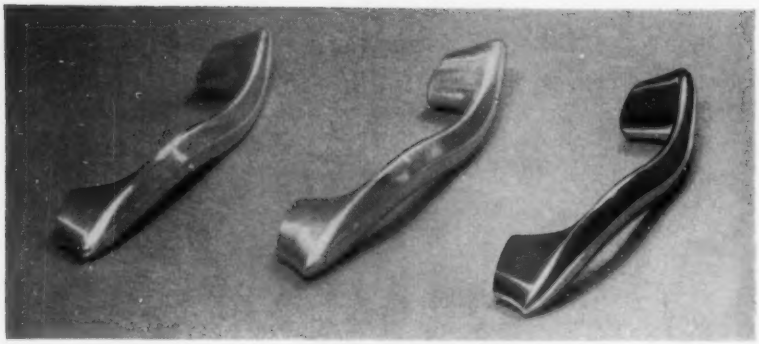

Three stages in the finishing of a zinc base die casting. Casting at left was buffed. Center casting was buffed and electrocleaned in Oakite 195. Casting at right was buffed, electrocleaned in Oakite 195, and plated. Note that center casting retains full buffed lustre and color after its electrocleaning in Oakite 195.

New electrocleaner for zinc die castings assures brighter plate... and cuts rejects!

Plating of zinc base die castings now becomes a more dependable, more economical operation with the introduction of Oakite 195, a *non-etch* anodic cleaner.

More dependable because the casting surface is not etched and its color not changed or darkened. Soils and films are effectively removed, yet the castings retain their buffed lustre. To help further in preparing the way for uniformly good plating results, this new electrocleaner has excellent rinsability in hot or cold water, and low foaming tendency.

And more economical by far, because of the sharp reduction in rejects due to poor pre-cleaning.

Oakite 195 can be used with direct, reverse and periodic reverse current, in still tanks and fully automatic set-ups. Where only a single solution tank is available, it is being used to clean a variety of metals—zinc, steel, brass, copper.

For more information about this important new development in cleaning before plating, write for descriptive folder F-10466 to Oakite Products, Inc., 34G Rector Street, New York 6, N. Y.

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Export Division Cable Address: Oakite

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For more information circle No. 59 on the Reader Service Card

TOLERANCES

continued from page 28

and the overall production rate is considerably slowed. To overcome either problem it is necessary to leave such holes uncored and to perform a secondary jig drilling operation. In this instance the cost saved by not coring holes can be applied to building a drill jig so that tool cost is not greatly affected. However, the jig drilling of such holes is a secondary machining operation with a resultant increase in piece price.

Angularity tolerances can be a particular headache to the die caster. There are four distinct cases conceived for plane surfaces. Draft requirements of walls naturally affect all four cases where applicable. The first case is where surfaces are in a fixed relationship in the same die section or are a part of the same moving die section. In either cast .005 inch tolerance is required for surfaces up to 3" in length with an additional .001 inch per inch for over 3" in length.

Surfaces formed in opposite die sections as well as those formed by one die section with a moving core in the same section require .008" tolerance up to a 3" surface length and an additional tolerance of .0015" inch per inch over 3" in length.

Angularity tolerance for cored holes runs .005 to .010 inch times the hole diameter divided by the maximum depth allowable under the depth diameter ratio for cored holes. For cored holes over 3" in depth the tolerance is .010 plus .003 inch per inch over 3". Draft requirements for the cored holes again must be applied where applicable.

In any case of angularity tolerance there is little that can be done in die construction to reduce the needed tolerance. Where the tolerances cannot be held in the as cast condition it is absolutely necessary to go to a rather costly secondary machining operation to maintain the desired results.

Lastly we come to tolerances involving concentricity. Here we again have several cases. The first case is where the surfaces are in a fixed relationship in the same die section. Here a T. I. R. of .004 can be maintained where the diameter

of the largest section is 3" or less. Over 3 inches requires an additional .0015 inch per inch. In this case shrinkage is the primary concern and the die can be adjusted to maintain it.

Where the surfaces are formed by opposite halves of the die the projected area of the casting is the controlling feature. For areas up to 50 sq. inches the tolerance is .015 plus basic tolerances; from 50 to 100 sq. inches it is .020 plus basic; and an additional .010 for each additional 100 sq. inches of projected area.

When the surfaces are made by two moving portions of the die the tolerance is .006" plus basic tolerance up to 10 sq. inches or projected area; .012 plus basic for 10-20 sq. inches; .018 plus basic from 20-50; and .025 plus basic for a projected area of from 50-100 sq. inch.

To overcome out-of-tolerance conditions in the last two cases it is necessary to add a secondary machining operation to hold the T. I. R. within limits with a necessary piece price increase. Little can be done to overcome this condition in die construction.

Wherever machining stock must be left the designer should leave .010 stock to overcome excessive tool wear, but not more than .020 stock on any surface to be subsequently machined.

Thus as can be seen from the foregoing, any time tolerances are tighter than the commercial standard they can be achieved but only at higher costs. This higher cost may be in the original tool charges, it may be a higher piece price due to slower casting cycles or secondary operations, or it may involve both. Take a long look at those tolerances applied – a little more freedom to the die caster may save a great deal of money.

Reference – "E" Series Products Standard by American Die Casting Institute

DOLLIN APPOINTS SOUTHEASTERN REPRESENTATIVE

DOLLIN CORP. producers of zinc and aluminum die-castings, has appointed Manufacturers Sales Co., as representative covering Virginia, North and South Carolina, Georgia, Florida, and eastern Tennessee.

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There's nothing unique about stressing product quality. But, at Roto-Finish we have an added incentive. The success of the Roto-Finish Customer's Man *depends* on providing the kind of dependable, mass-production finishing service which builds customer satisfaction, and results in a steady repeat business.

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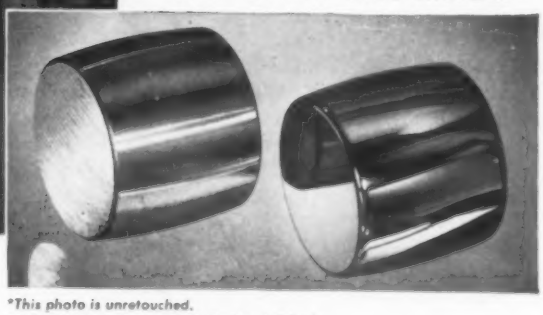
If you're now barrel finishing, our Customer's Man will welcome an opportunity to work with you in your own plant to show you how to get the finish you want, faster, and at lower cost.

If you're hand finishing, he can show you how to save up to 80% of your present finishing costs.

WANT PROOF? Then write or phone your Roto-Finish Customer's Man today.

ROTO-FINISH CASE HISTORY



*This photo is unretouched.

MATERIAL: Bearing steel, 61 Rockwell C Scale.
DIMENSIONS: 1.213" dia. x 1.015".
FINISH BEFORE: Ground to 10 RMS.
FINISH AFTER PROCESSING: 2 to 4 RMS, *(with no dimensional change).*

Roto-Finish COMPANY

3716 Milham Road
KALAMAZOO, MICHIGAN
Phone: FIreside 3-5578

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USEFUL LITERATURE, CATALOGS, MANUALS

any of these technical publications may be obtained by circling the appropriate numbers on the Reader Service Cards, Pages 40-41

PROCESSES

Aluminum Mill Products: 154

THE ALUMINUM ASSOCIATION—has issued a 22-page booklet, "Nomenclature for Wrought Aluminum Mill Products". Contents include the definitions and miscellaneous terms for Sheet and Plate Products, Foil and Foil Products, Wire, Rod, Bar, Shapes and Tubular Products and Forgings.

Extrusions: 155

TRIM ALLOYS INC.—Brochure describes the company's completely integrated extrusion plant, from billet casting and die construction to post-extrusion fabricating.

Extrusion Tools 156

AJAX STEEL & FORGE CO.—13-page bulletin discusses the care of extrusion tools; containers, liners and rams. Each is described and the causes of damage are listed. A list of precautions is furnished that will help prolong part life.

Plaster Mold: 157

AIRTON, INC.—Brochure describes precision cast components and foundry techniques. Aluminum, magnesium and beryllium copper alloys are compared. Advantages of the plaster mold and investment processes are given. X-Ray and cutaway drawings illustrate steps in the casting, machining and testing procedure.

Vacuum Impregnation: 158

NRC EQUIPMENT CORP.—American and European high vacuum impregnating, drying, degassing, and filling techniques are described. Technical data and graphs detail the superior electrical and physical characteristics from high vacuum processing.

Metal Specifications: 159

WAIMET ALLOYS CO.—"Metal Specifications and Practices in the United States", is a summary of a lecture by Roger F. Waindle. The 16-page booklet contains graphs, photomicrographs and electron micrographs to aid in describing the development and standardization of casting alloys used in the United States.

Sinterings: 160

KEYSTONE CARBON CO.—Powdered metal parts design and production handbook discusses applications, design considerations, gears, production materials, secondary operations, consultations, and information required for correctly basing quotations.

Impact Extrusions: 161

IMPACT EXTRUSION PRODUCTS, INC.—"Cut Production Costs with Aluminum Impacts" is the title of a helpful folder that explains the advantages of impact extrusions.

Aluminum Extrusions: 162

LIGHT METALS CORP.—The company's facilities for extruding aluminum, fabrication and assembly, including anodizing and silk screening, are outlined in an illustrated brochure.

Extrusions: 163

PRECISION SHAPES, INC.—Brochure presents the company's facilities for producing extruded shapes. Illustrations and tolerances attainable are included.

MATERIALS & EQUIPMENT

Molds: 164

MEEHANITE METAL CORP.—Bulletin No. 23 describes permanent molds used in the production of metals.

Iron Powders: 165

REPUBLIC STEEL CORP.—"Technical Information on Republic Iron Powders" is a 52-page book on cdf and MS Iron Powders. Specifications for each powder are furnished.

Die Steels: 166

AJAX STEEL & FORGE CO.—The company's complete die steel service from ingot to finished product is described in an illustrated brochure.

Extrusion Equipment: 167

WATSON-STILLMAN PRESS DIV., FARREL-BIRMINGHAM CO., INC.—Literature is available on a complete line of extrusion presses and hydraulic stretchers.

Electrical Conduit: 168

ALUMINUM CO. OF AMERICA—Booklet outlines the mechanical and electrical advantages of aluminum rigid conduit that can be purchased and installed at a cost comparable to, or less than conventional conduit.

Temperature Control System: 169

GENERAL ELECTRIC CO.—Bulletin GET-2741-6 explains the operation of a temperature control system that consists of a Type HP-35 millivoltmeter controller and has a new torodial design amplistat and saturable reactor.

Metal Processing Equipment: 171

STANAT MANUFACTURING CO., INC. — Literature outlines features of wire flattening mills, levelers, bull blocks, slitters, rolling mills and accessory equipment, and presents facilities for building machinery to meet special requirements. Bulletin No. 1057.

Tool Steel Production: 172

UDDEHOLM COMPANY OF AMERICA, INC. — A booklet entitled, "The Story of Uddeholm Tool Steel", tells how this Swedish company produces high grade tool steel, and lists the tool steel qualities available from stock.

Powder Metallurgy Lubricants: 173

NOPCO CHEMICAL CO. — New technical data report details the properties and uses of a complete line of products specially formulated to increase apparent density of metal powders and provide internal lubrication for sinterings.

Miniature Thermocouples: 174

THERMO ELECTRIC CO. — A comprehensive 28-page catalog describes miniature thermocouples of gas-

continued on page 54

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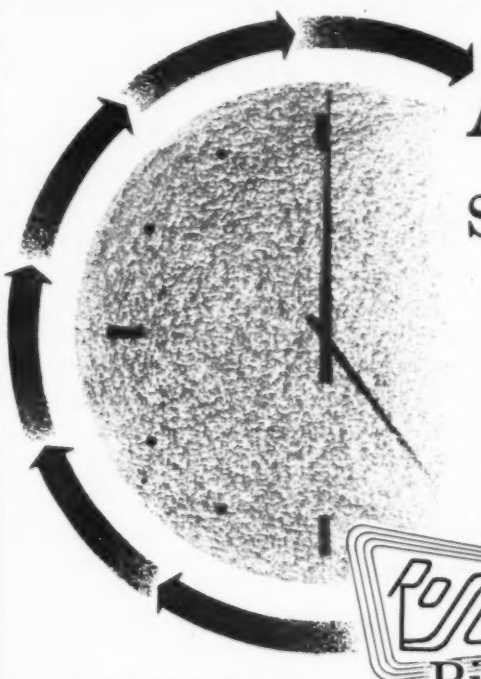
Plaster Mold Castings made from
BRASS • BRONZE • ALUMINUM • BERYLLIUM COPPER



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When your production department is yelling at you to get those castings out "yesterday", you'll get the fastest service on your dies by coming to R. O. Schulz. We're set up for speed. We have the machines to make your dies, whether they're 15 tons or a few pounds, and the skilled designers and die makers to make them right. You get top quality workmanship at lowest cost when you take advantage of our specialized die and mold making facilities.

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USEFUL LITERATURE

continued from page 52

ket, bayonet, protected and shielded design. Explains proper use for each kind, and includes full specifications and a Fahrenheit-Centigrade temperature conversion table.

Prealloyed Steel Powders: 175

VANADIUM-ALLOYS STEEL COMPANY — Ready Reference Data Sheet outlines advantages of prealloyed steel powders including stainless steels, heat treatable alloy steels, and various spcial purpose alloys.

FINISHING

Barrel Finishing Equipment: 191

WHEELABRATOR CORP.—Design features and specifications of the Model 30 series Techline barrel finishing machines are presented in a new booklet.

Conversion Coatings: 192

MAC DERMID INC.—Technical Data Sheet No. 76 describes compounds for producing chromate conversion coatings on zinc and cadmium plated work, on zinc die castings, and on aluminum.

Fasteners: 193

TINNERMAN PRODUCTS, INC.—The company's one-piece, self-locking, self-retaining Speed Nuts are described, with their many uses, in Bulletin No. 350-1.

Sealing & Brightening Finishes: 194

CONVERSION CHEMICAL CORP.—Fact Sheet F-2 lists chromate sealing and brightening finishes for zinc, zinc die castings, cadmium, copper & brass, and aluminum.

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Chemical Conversion Coatings: 195
E. F. HOUGHTON & CO.—A helpful booklet shows applications of the company's phosphate coatings. Illustrations and data tables are included.

Wet Blast Equipment: 196
WHEELABRATOR CORP.—Bulletin 100 describes Liquamatte Model 43, the company's latest addition to their line of wet blast equipment.

Barrel Finishing Machine: 197
METAL FINISH, INC.—The Vibraslide Barrel Finishing Machine, which introduces a vibrational force into the barrel while it is rotating, at a slow non-damaging speed, is described in Bulletin 225.

Rust Proofing: 198
MAC DERMID, INC.—An iron-zinc phosphate process for rust proofing zinc base die castings is described. Phosphotex promotes adhesion and durability of paint finishes, provides a mechanical bond for paint, and protects against rust.

Test For Continuous Strip Anodizing: 199
HANSEN-VAN WINKLE-MUNNING CO. — Literature describes a new test line for solving problems in continuous high-speed strip anodizing, sealing and dyeing. The line will duplicate any plant condition.

Belt Sander: 200
BOICE-CRANE CO.—A 6" x 60" hand-stroke belt sander, which features a machine-tool type base and free-rolling work table, is described in a Catalog Sheet.

Tumbling Equipment: 201
CROWN RHEOSTAT & SUPPLY CO.—Catalog describes a complete line of tumbling machines and accessory equipment for deburring, ball burnishing, and finishing.

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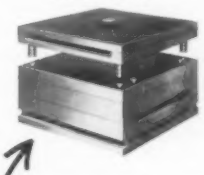

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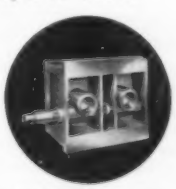

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58-E

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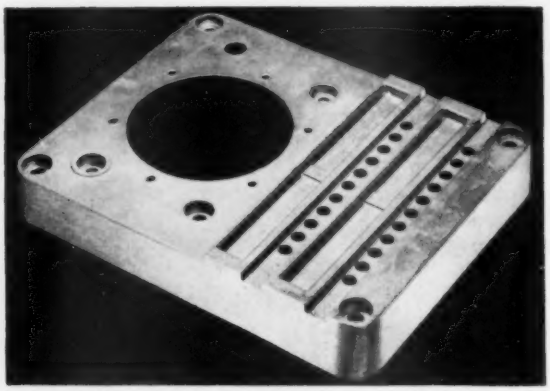

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a base for United States Navy electronics communicator equipment was chosen in preference to other casting methods because of low original die cost. The casting has a clean appearance and was cast by Eastern in accurate detail, especially coring the holes.

Combined quality and economy in a casting results from a unique combination of assets. At Eastern Casting Corp., years of diversified foundry experience are coupled with the most modern facilities obtainable . . . the results are metallurgically sound castings which meet a wide range of requirements.

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R. L. Huston, Chief Engineer for Bonney, says, "We went to a powdered metal part on our shifter because the cost of machining this part from steel would have been prohibitive. Also, we would have had to change the entire design of our ratchet. We contacted no less than a dozen fabricators of powdered metal. Reese Metal Products Corp. was the only establishment able or interested in tackling this problem with us."

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ALUMINUM EXTRUDERS COUNCIL MEETS

The third quarter meeting of the Aluminum Extruders Council was held September 29 and 30 at the Edgewater Beach Hotel, Chicago. The council is composed of companies who do aluminum extruding and supply companies associated with the aluminum extrusion industry.

Among the various activities of the council are the development and setting of standards for the industry. Thus far, standards have been developed or are being developed in areas such as nomenclature, size and dimensions, tolerances of dies, capacity of billet diameters and distances to be allowed for tooling. Other areas in which standardization and data collection have been recommended are: die lubricants, dummy blocks and ejection or clean-out blocks, daylight between die and container in the stripped condition, safety features and safety interlocks on presses and auxiliary equipment, and alloying ingredients of billets.

New companies admitted to membership at this meeting are: The B & T Metals Co., General Extrusions, Inc., Kewneer Co., Precision Extrusions, Inc., and Wells Aluminum Corp.

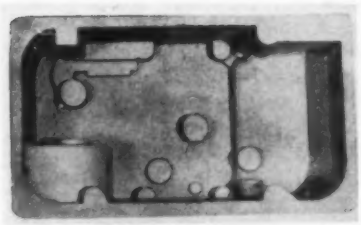
The next meeting will be Dec. 4-5 at the Sheraton-Park Hotel, Washington, D. C.

ICI TO MEET IN NEW YORK

The fall meeting of the Investment Casting Institute will be held at the Hotel Roosevelt, New York City, on November 11, 12, 13.

A special management conference will feature the meeting. Leading management authorities will discuss specific areas of management responsibilities and their relation to profit and growth in the investment casting industry. This program will cover two of the three days of the meeting. A feature of the management conference will be four separate meetings on November 13, for the different management groups within any company.

The meeting is for ICI members only. Other companies who would like to attend should contact the ICI at 27 East Monroe St., Chicago 3, Ill.



EXCESS METAL couldn't be designed out of this sand casting so:

FROM 2.57 POUNDS . . .

TO 1.13 POUNDS
as a
PLASTER MOLD casting with a wall thickness of .080" and undercut bosses.

Why Use Plaster Mold Castings?

- Low tooling costs.
- Rapid design change.
- Thin wall sections.
- Good surface finish.
- Pressure tight.
- Small holes can be cored.
- Undercuts and recesses can be cast.
- Wide choice of non-ferrous metals.
- Metal savers are easily designed in.

Why cast excess metal?

Cut Down Those Overweight Castings

JUST try to take one pound out of a sand casting!

Sometimes you can, but Admiral Corporation couldn't—so they changed to a vacuum plaster mold casting for their electronic housing.

Here's why they changed:

1. It was too heavy.
2. Looked too rough.
3. Couldn't be redesigned in sand.
4. Required a lot of expensive machining.
5. Was not constantly pressure tight.

The housing, as a sand casting, weighed 2.57 pounds, one pound more than the design allowed. It was impossible to remove weight by eliminating or lightening functioning parts that are mounted in the housing. The only way to save weight was to take it out of the casting. But it couldn't be done on the sand casting.

For the unit to work right, the castings had to be pressure tight at 20 pounds air pressure. Many castings failed this test. Also, the casting was extremely rough in appearance and required expensive machining.

Now, redesigned as a precision plaster mold casting by the Universal Castings Corp., the housing weighs 1.13 pounds, light enough to meet specifications. The illustrations show the differences between the two castings.

The engineers at Universal redesigned the housing. The walls were cast .080" thick, eliminating metal and cutting weight. The bosses were undercut, leaving only enough metal for the length of thread required. This also cut weight.

The as cast surface is smooth enough for use without machining. It only needs minor drilling and tapping. The casting, which measures 8" x 4⅝" x 2½", successfully passes the 20 pound air pressure test. Best of all, rejects have been eliminated.

HEVI-DUTY CO. BUYS STROMAN FURNACE

HEVI-DUTY ELECTRIC COMPANY announces the purchase of the Stroman Furnace & Engineering Company from The Peterson Oven Division of Baker-Perkins, Inc. The addition of this fully engineered, well established line of furnaces will complement the furnace division purchased from Eclipse Fuel Engineering Company by Hevi-Duty in July, 1958.

The Stroman purchase adds to Hevi-Duty's line an electric reverberatory furnace for holding molten metals, as used in the die casting and permanent molding industry.

A newly developed automatic slug-casting machine, used primarily to prepare slugs of aluminum or other soft metals for impact extrusions, is one of the important products included in the acquisition.

All equipment formerly produced by Stroman will be manufactured in the new Hevi-Duty plant at Watertown, Wisconsin. All sales and engineering records for previously produced Stroman furnaces will be maintained by Hevi-Duty and service or replacement parts may be obtained by writing Hevi-Duty Electric Company.

NEW COMPANY ENTERS DIE CASTING FIELD

EMERICK, PUNKE, ROBINSON

CAST-O-MATIC, a new corporation, has entered the zinc and aluminum dies castings field under the presidency of J. J. Punke, past executive vice-president of Precision Castings.

On the executive and technical level, Cast-O-Matic has attracted well-known veterans in die castings firm leadership. The executive vice-president of the new corporation is S. F. Emerick, for 20 years an executive of nationally known firms, sixteen of which were spent in the die casting field; D. H. Robinson, Cast-O-Matic vice-president and Secretary, serves as factory manager, a position similar to that held in another leading die castings firm for nearly 10 years.

Mr. Punke was with Hyatt Roller Bearing Co., the Packard Motor Car Co., and General Motors for 18 years prior to joining Precision in 1938. He directed the 10 plants in the Precision complex before leaving to become a principal in Cast-O-Matic.

Other personnel includes Phillip A. Surdyke, Sales Manager, D. A. Danforth, Die Castings Estimator, Frank Agan, Chief Inspector, Herman Foote, Casting Superintendent, and C. S. Holder, Comptroller.

The new firm has been granted membership in the American Die Casting Institute, the Certified Zinc Alloy Plan, and the Manufacturers Association of Syracuse.

SAUBESTRE JOINS ENTHONE

Edward B. Saubestre has joined ENTHONE, INC., a subsidiary of American Smelting and Refining Company, as Assistant to the Research Director.

WABASH

Quality Aluminum Alloys

OUR METALLURGICAL DEPARTMENT, HAVING A PRACTICAL WORKING KNOWLEDGE OF FOUNDRY PROCEDURE, IS AT YOUR DISPOSAL

WABASH SMELTING, INC.
FACTORY STREET · WABASH, INDIANA
TELEPHONE: WAbash 1400

For more information circle No. 67 on the Reader Service Card

By bolting plaster cores together . . .

HOW TO USE PLASTER MOLD CASTINGS

You Can Cast Large, Complex Shapes

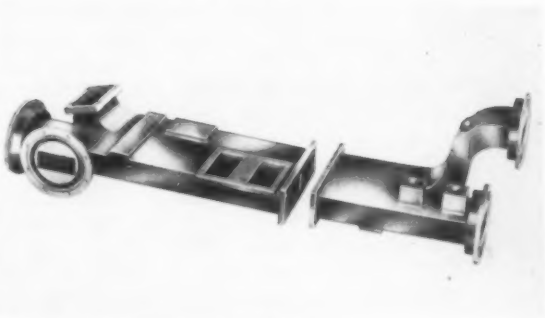
PART size, shape and complexity are all considered when deciding on a method of manufacture. This waveguide has an over-all length of 45 inches and weighs 17 lbs. It is large and complex, and its function demands close internal dimensions and a good surface finish.

Can a part like this be made economically?

The answer: Yes—When this newly developed technique is incorporated into the plaster mold casting process.

Perfected by the Precision Castings Division of Airtron, Inc., it means that cores are developed in separate sections and then bolted together accurately with studs and nuts. This sectional process gives better control of the internal dimensions and insures greater accuracy.

The waveguide is only one example of parts being cast economically by this method. Its cores are prepared in two sections which are bolted together. This core preparation makes it possible to hold cross-sectional tolerances of ± .003" on the **E** plane, and .002" on the **H** plane, and an inside surface of 65 microinches RMS. The assembly is cast in two 356 aluminum sections.



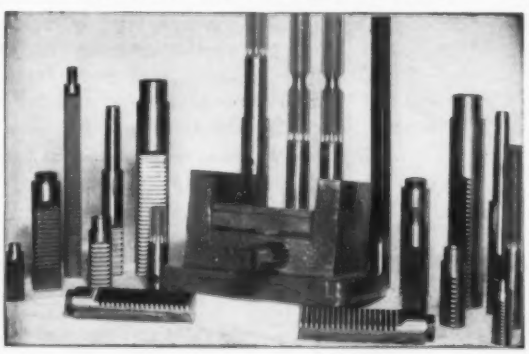
A NEW TECHNIQUE produced this casting.

APPROXIMATE VALUES FOR PLASTER MOLD CASTINGS IN ALUMINUM

	Maximum	Nominal	Minimum
Size	30"x30"x15"	12"x6"x4"	1"x1"x1"
Weight	1 lb.	2 lbs.	.01 oz.
Tolerances	—	±.003"/inch	±.0015"/inch
Finish as Cast	—	64 microinches	32 microinches
Draft	—	.010"/inch	.001"/inch
Thickness	—	.080"	.030"
Thickness Variation Ratio	8 to 1	3 to 1	—

PEERLESS "FLAME-A-LOY"® PINIONS and RACKS

FOR DIE CASTING & PERMANENT MOLDS



Standardized To Mate and Interchange With Each Other For Longer Wear At Less Cost.

—We Welcome Your Inquiries—

PEERLESS GEAR & MACHINE CO.

140 E. WAYNE STREET
DUNKIRK, OHIO
TEL. 3101

Precision Products Since 1921

*Trademark Registered

For more information circle No. 44 on the Reader Service Card

BEST FOR UPSETTING PIERCING EXTRUDING FORGING

PRODUCES MORE AND BETTER PIECES BETWEEN DIE CHANGES.

A graphited product for use in working hot metals of all kinds. Good in temperatures up to 2200° F and above. Keeps work cool and extends the life of dies and punches. Highly adhesive, may be applied by brush or swab or diluted with oil for spraying.

Bulletins describing Fiske's 514A Hot Die Lubricant and other specialty lubricants and coolants sent on request.

FISKE'S Since 1870 METAL WORKING LUBRICANTS

FISKE BROTHERS REFINING CO.

129D LOCKWOOD STREET, NEWARK 5, N. J.

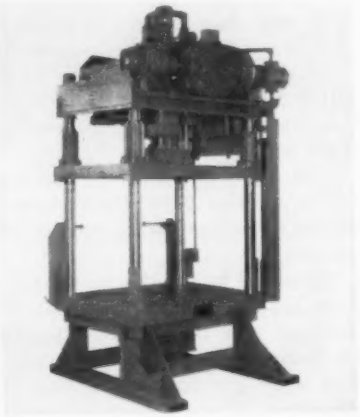
Plants: Newark 5, N. J. and Toledo 5, Ohio

For more information circle No. 21 on the Reader Service Card

NEW PRODUCTS AND DEVELOPMENTS

Want complete details on these announcements? Use the Reader Service Cards. You'll find them facing page 40 of this issue

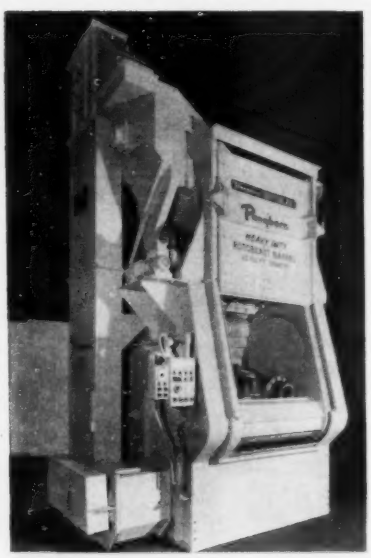
AIR-HYDRAULIC TRIM PRESS . . . is fast acting



This 35 ton trim press, for trimming die castings, swaging, stamping, blanking, etc., has a 48" x 40" free working area inside of the 4" tie bars. Manufactured by B & T MACHINERY CO., the press has a 30" stroke, approach speed of 1400 inches per minute, pressing speed of 140 inches per minute and a return speed of 700 inches per minute. The machine is 11 feet high and weighs 19,000 pounds.

The high speed of the machine is obtained by means of air being forced in behind the piston ram under an accumulator system. A fast-acting valve allows free flow without cavitation behind the head. As the ram travels, a solid column of oil is forced in behind the piston by 20 pounds of air pressure. By means of a cam just prior to the trimming cycle of the pump pressure is cut in for the shearing action of the press. This action makes the high cycling speeds possible.

Circle No. 205 on the Reader Service Card.



BLAST CLEANING MACHINE . . . has high capacity barrel

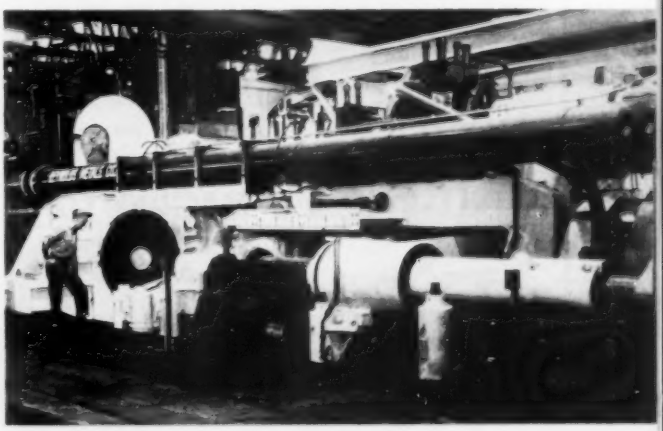
The Rotoblast Type "20 GN" blast cleaning barrel features a new high-capacity barrel that increases cleaning speed and flexibility while reducing abrasive loss. A 30 HP motor allows the 195-3 "RG" wheel to throw 50,000 lb of abrasive per hour for rapid blast cleaning. This machine, manufactured by PANGBORN CORP., features an extra-heavy work conveyor which will allow loads up to 3500 lb, with single pieces weighing up to 800 lb each, to be handled. For economy of maintenance, the wheel housing is lined with wear resistant alloy plates.

The barrel is driven by V-belts to spur gear reducer mounted directly on the work conveyor shaft. When operating the conveyor travels upward to tumble the castings. After cleaning, the conveyor direction is reversed to discharge the load.

An abrasive-tight housing and doors have been developed for the machine. This permits economical use of the newer type abrasives. During barrel operations, an effective cleaning and reclaiming system removes all sand and debris from the abrasive.

Circle No. 206 on the Reader Service Card

NEW EXTRUSION PRESS . . . is flexible

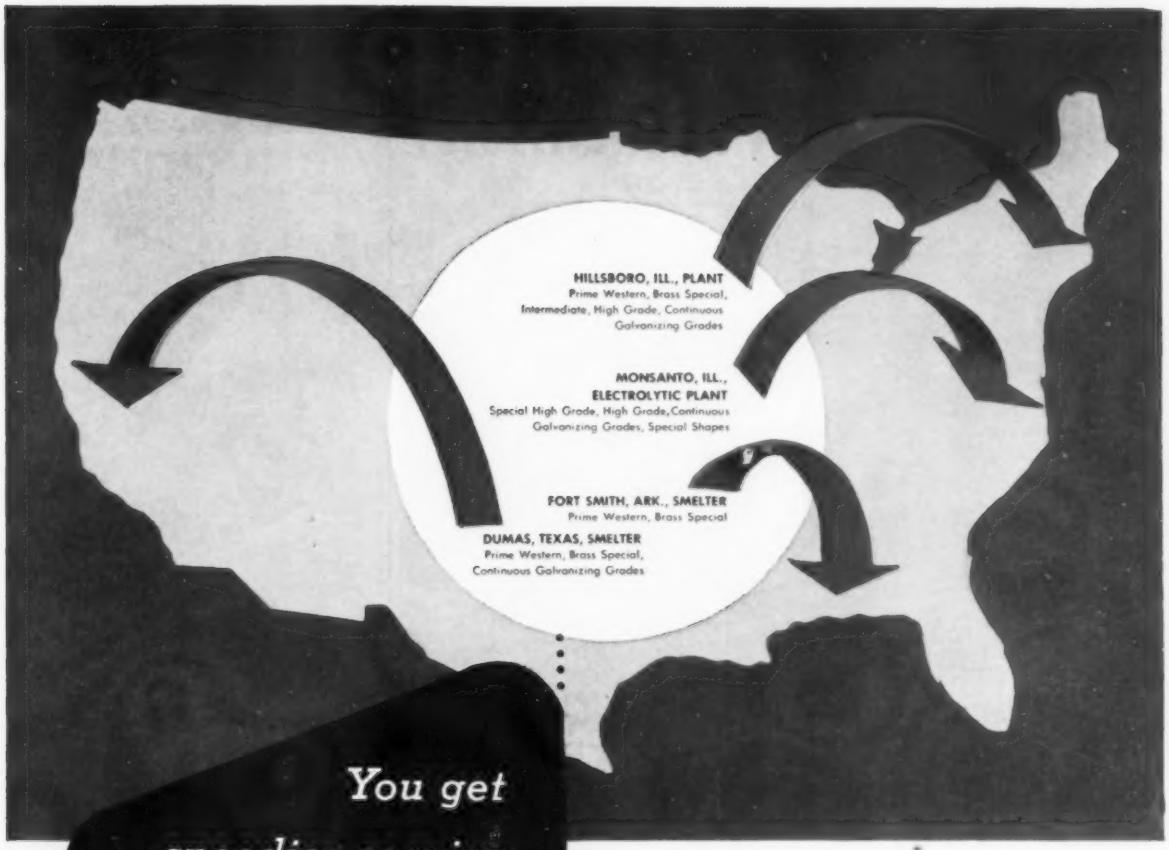


The property of the U.S. Navy, this 6,000 ton capacity press, manufactured by LOEWY-HYDROPRESS DIV., BALDWIN-LIMA-HAMILTON CORP., is the most flexible press built because of these features: 1. push-button shift from high to low speed; 2. Facilities for rapid container changes; 3. Extensive automation; 4. Independent mandrel movement; 5. Provision for extruding rectangular shapes.

The push button shift, from high to low speed makes it possible to quickly switch from extruding non-ferrous metals to extruding steel and titanium.

The press can extrude billets up to 50" long and 20" in diameter into shapes as long as 100' and as large as 16" in diameter.

Circle No. 207 on the Reader Service Card


HILLSBORO, ILL., PLANT
Prime Western, Brass Special, Intermediate, High Grade, Continuous Galvanizing Grades
MONSANTO, ILL., ELECTROLYTIC PLANT
Special High Grade, High Grade, Continuous Galvanizing Grades, Special Shapes
FORT SMITH, ARK., SMELTER
Prime Western, Brass Special
DUMAS, TEXAS, SMELTER
Prime Western, Brass Special, Continuous Galvanizing Grades

You get speedier service from the ZINC ZONE

Central location of American Zinc plants assures prompt deliveries of slab zinc to any point in the nation.

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
LEAD-FREE and LEADED ZINC OXIDES
ZINC CARBONATE
GERMANIUM DIOXIDE
AGRICULTURAL LIMESTONE
CRUSHED STONE

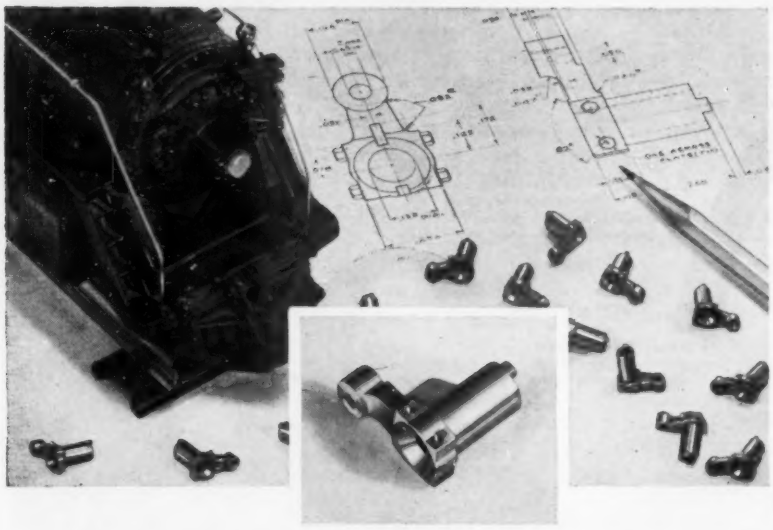
American Zinc Sales Company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY

Columbus, Ohio • Chicago • St. Louis • New York • Detroit • Pittsburgh

For more information circle No. 5 on the Reader Service Card

GRC DIE CASTING HELPS LIONEL ACHIEVE TINY PART AUTHENTICITY



Tiny, intricate, too costly to make in their own plant, GRC's specialized techniques made this Toy Crank economically possible

While it would seem more advantageous for manufacturers to make all parts in their own plants, some have found that a specialist can do it cheaper, faster, and sometimes even better. This Lionel toy crank is an example. GRC specialized techniques made it possible for them to produce this tiny authentic part more quickly and more economically than Lionel could themselves. Die cast in zinc alloy in a single automatic operation, the cost of the GRC crank was little more than $5.00 per thousand in lots of 500,000.

Miniature in size, intricate in shape, this crank is typical of the many small parts problems economically solved by GRC. It is typical too of the close tolerances and uniformity achieved by Gries' fully automatic methods. Whether simple or complex, quality is high — no secondary operations, no scrap loss. GRC parts leave the machines ready for immediate use.

If you have a small parts problem, need flexibility in design, write for Gries' informative bulletins on **Zinc Alloy Die Castings and Injection Molded Plastics**, or send prints for quotations. There is no minimum size. Maximum: 1¾" long, ½ oz. in zinc alloy; 1¼" long, .03 oz. in plastic.

GRC die cast zinc alloy high series cap nuts now cataloged in stock

Never before available to industry as a stock item, GRC now offers prompt delivery from stock on cap nuts with up to 50% greater thread depth, in a complete range of hex sizes from 5/16" to ⅝"; thread sizes from #6 through 7/16".

GRC offers wide range of head types and sizes in molded nylon screws

Molded by GRC's specialized techniques which make the most of nylon's outstanding properties . . . these high quality, close tolerances screws have clean accurate threads, come in a variety of types, thread sizes, lengths and points.

Yours for the asking —GRC HANDY GUIDE TO LOW COST QUALITY FASTENERS

WORLD'S FOREMOST PRODUCER OF SMALL DIE CASTINGS

GRIES

GRIES REPRODUCER CORP.

157 Beechwood Avenue, New Rochelle, New York • NEw Rochelle 3-8600

For more information circle No. 22 on the Reader Service Card

continued from page 60

MILLING MACHINE
. . . features high production

The U2 Rapidmil milling machine has two speed ranges encompasing 30-1500 rpm and feeds extending from .65" to 21.5". Backlash eliminator, mechanical overloads, and one-shot lubrication have been added to power and rapid traverses in all directions. The machine manufactured by BENTLY INDUSTRIAL CORP. also features nickel-chrome hardened and ground gears which run on splined shafts.

Circle No. 209 on Reader Service Card

SINTERING PRESS
. . . is adapted for automatic sizing of parts

F. J. STOKES CORP. has introduced a device that will adapt its standard compacting presses for automatic sizing operations. Essential component of the adaption is the special feeding mechanism — a horizontal, rotating dial-plate with a series of circular recesses around its perimeter into which are inserted individually designed holding plates for the particular parts.

MONARCH EXPLORATORY ENGINEERING

...a new freedom for creating better end-products within production budgets

Many ideas about what can or cannot be accomplished with castings are now obsolete. Monarch exploratory engineering in finishes, surface texture, metallurgy and production methods has opened new design horizons.

Consult with Monarch engineers, on your current product or new project. They will bring you their wide experience in casting design, surface treatments and mass-production techniques that have been successfully applied to many outstanding products.

You can profit through Monarch's advanced technology. Monarch engineering consultation is available to you without obligation. Call or write today.

MANUFACTURING in MOLTEN ALUMINUM ACHIEVEMENTS

MONARCH ALUMINUM MFG. COMPANY

9205 Detroit Avenue Cleveland 2, Ohio

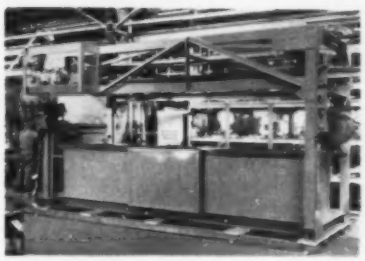
Circle No. 38 on the Reader Service Card

The dial-plate is mechanically driven, independently of the main press drive, but is synchronized with it. The company is offering its standard compacting presses equipped with the new device.

Circle No. 213 on Reader Service Card

CONVERSION COATING MACHINE

. . . is fully automatic



A fully automatic, straight-line conversion coating machine has been introduced by HANSON-VAN WINKLE-MUNNING CO., that is recommended for blackening, phosphating, bright dipping, pre-cleaning and pickling.

"Convert-O-Matic" provides maximum cycling flexibility by settings of selective timers for each treatment tank. Once set and running the machine requires no further labor.

Circle No. 210 on Reader Service Card

DIE HANDLING UNIT

. . . is battery powered

A high-lifting platform truck for moving and storing stamping dies has been introduced by the INDUSTRIAL TRUCK DIV., CLARK EQUIPMENT COMPANY.

The "Powerworker" Die Handler will lift dies weighing up to 4000 lbs. and tier them in storage. Dies are pulled on or pushed off the platform with a T-shaped hook driven by a hydraulically powered worm screw. The platform is 26" wide and is available in lengths of 36" to 60" in six inch increments.

Circle No. 208 on Reader Service Card

ELECTRONIC POTENTIOMETERS

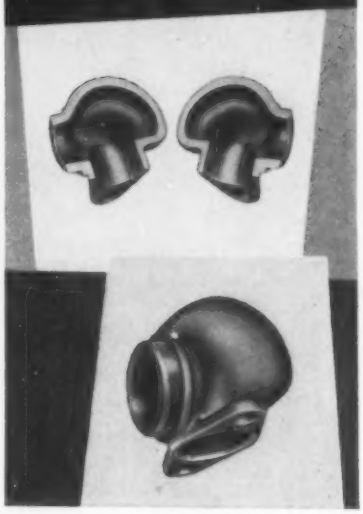
. . . will fit 19" relay rack

THE BRISTOL CO. has introduced a new line of electronic potentiometers and bridge instruments, available in case sizes that will fit into standard 19" relay racks.

Circle No. 219 on Reader Service Card

continued on next page

two halves *don't* make a hole!



. . . *with* INVESTMENT CASTING *it's made in one piece.*

We don't tackle casting problems halfway at Hitchiner.

Here's a cross section where the inside dimensions are greater than the holes. Originally made in sections and assembled — now the whole unit is precision cast and is lighter and stronger.

Where application requirements demand that a part be of intricate shape; of unusual contour, of fine detail, or of metals difficult or impossible to machine — investment casting provides an efficient and economical solution.

Only your production costs are cut in half when you utilize the efficiency of investment casting. You save time and plenty of labor. And . . . you'll have a wide selection of metals; the non-ferrous group, the carbon and low alloy steels, the hard-to-form, hard to machine high alloy steels . . . even cobalt base alloys.

For complete details, see this new illustrated, informative booklet on the art of Investment Casting. It could be the best investment you ever made.

HITCHINER

MANUFACTURING COMPANY, INC.

MILFORD 43, NEW HAMPSHIRE

Representatives in Principal Cities

Circle No. 66 on the Reader Service Card

This part cast from a magnetic alloy, Hipernik®, cut production costs 80%

CUT COSTS WITH INVESTMENT CASTING OF MAGNETIC ALLOYS

Many of today's alloys are difficult or impossible to machine or forge. Many magnetic parts and components are so intricate in shape that to machine them would require multiple set-ups. Investment casting minimizes machining costs, yet retains the magnetic properties you need.

Westinghouse can provide castings of high-nickel magnetic alloys that retain comparable magnetic properties of wrought materials. With value and cost analysis so important, consider precision investment casting of your magnetic product components.

Whether you need small quantities of prototype parts or production runs, the Westinghouse Metals Plant has the complete metal facilities and experienced engineers to help improve cost and quality of your component parts. For further details on Investment Castings, ask for DB-52-500. Write Westinghouse Electric Corporation, Materials Manufacturing Department, Blairsville, Pa. J-05006

YOU CAN BE SURE...IF IT'S Westinghouse

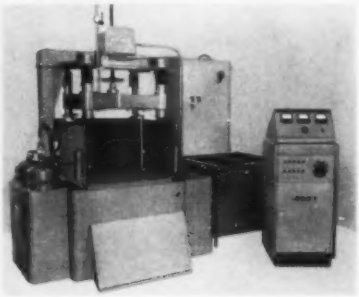
For more information circle No. 51 on the Reader Service Card

NEW PRODUCTS

continued from page 63

ELECTRO-CHEMICAL MACHINING

. . . is new process



Machining may now be done from start to finish, electronically. EIOX CORP. has developed this new process that uses an electrode similar to that used in electrical discharge machining. Both the electrode and work piece are submerged in a saline solution, metal is removed by an electro-chemical action controlled by a highly sensitive servo feed system that automatically advances the electrode into the work piece as the machining progresses.

Circle No. 223 on Reader Service Card

IONIZATION GAUGE

. . . has choice of filaments

A flanged all-metal Bayard-Alpert type ionization gauge with non-burnout iridium filament, or double tungsten filament is now available from VEECO VACUUM CORP. The type "FG" gauge is an ideal measuring instrument both in the high vacuum region and in the ultra-high vaccuum region below 10^{-8} mm Hg.

Circle No. 214 on Reader Service Card

HOW TO USE
DIE CASTINGS

Cost At Assembly ...30% Less

DIE CAST TO TOLERANCES of ±0.002" where required, the zinc die casting at left costs 30% less than sand casting at right.

Sand Cast Clamp

Cast and trim
Mill two slots
Mill two sides
Drill and tap two holes
Make separate angle index plate
Bolt index plate to clamp

Die Cast Clamp

Cast and trim

IT'S an axiom — cut out machining operations and you lower costs. Baldor Electric Co. found that out when they converted from a sand casting to a zinc die casting.

The product is the calibrated clamp used for carbide tool grinder tilting tables.

Not only did the change to a die casting save money, but it resulted in a better product. Where before the clamp had to be a two piece assembly, it is now a single casting.

No finishing is required on the zinc die casting and using a single cavity die the A. B. Mueller Co. makes them at a rate of 160 to 180 pieces per hour.

Don't be CLOBBERED!

with High Equipment Investment or Labor Costs for CLEANING and PHOSPHATING PROCESSES

Use "Phosteem"

Low Equipment Cost! No Sacrifice in Quality!

And if you want:

● Top Corrosion Resistance, Excellent Paint Durability, Low Operating Costs, Low Labor Costs (under practical production methods too) with a very low equipment investment, PHOSTEEM is the *answer* . . . used on Cabinets, Trucks, Trailers, Busses, Air Conditioners, Farm Implements, Caskets and Large Bulky Equipment . . . Adaptable for any kind of metal: Steel, Aluminum, Galvanized, etc.

METALPREP
GALVAPREP
LYFANITE
PHOSTEEM
PREP-N-COTE
AND OTHER
Metal Conditioning
Rust Removing
Phosphatizing
products for
STEEL, ALUMINUM,
ZINC, CADMIUM, etc.

N.C.Co.

Ask for Phosteem Bulletin 55-137

NEILSON CHEMICAL CO.

Southeastern Distributor: P. H. ROSS CO. Charlotte, North Carolina

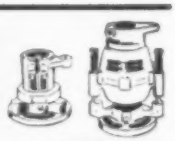
2330 Gainsboro, Detroit 20 (Ferndale), Michigan

Allentown, Penna. Los Angeles, Cal. Windsor, Ontario

For more information circle No. 57 on the Reader Service Card

LET'S PUT OUR MULTIPLE HEADS TOGETHER!

. . . and plan your small hole drilling & tapping operation on a low cost, maximum production basis

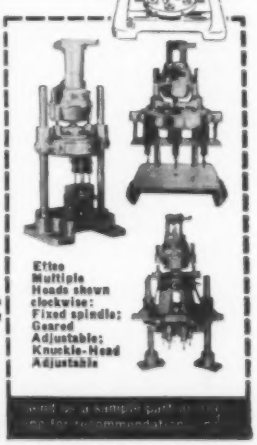


ETTCO-EMRICK
MULTIPLE SPINDLE HEADS

UNIT-ENGINEERED for drilling or tapping on any drill press

No one type will do for every job. That's why we make 'em all—and the correct custom tooling for faster handling of the parts. The Ettco system is a completely integrated service; not just multiple heads with spindles reaching into the air!

Ettco engineers can tell you without obligation which type best suits your specific job. They're all easily attachable to your present drill press, tapping machine or automated special. Standardized, reuseable components mean lowered costs. Interchangeable face plates permit quick switch from tapping to drilling. Write for catalog.



Ettco Multiple Heads shown clockwise: Fixed spindle; Geared Adjustable; Knuckle-Head Adjustable

Ettco-Emrick

The only complete line manufacturer of drilling & tapping equipment for the entire small hole field

See your authorized Ettco distributor

ETTCO TOOL & MACHINE CO., INC.
594 Johnson Avenue, Brooklyn 37, N. Y.

For more information circle No. 56 on the Reader Service Card

Proved–

the Long-Life of Light Metal Die Castings in Power and Hand Mowers

More and more manufacturers of hand operated and power driven, rotary and reel-type, Lawn Mowers are using components, such as shown in the photograph, of die cast aluminum and magnesium. These applications of aluminum and magnesium die cast parts have proved themselves through years of operating experiences. For example: one die cast gear, such as shown in the upper right hand corner, has been used continuously for 10 years. During that time 1,500,000 lawn mowers have been equipped with these gears . . . surely proof of long-life and satisfaction to both the manufacturer and ultimate consumer.

Important production cost savings are effected also through the minimizing or virtual elimination of machining operations, plus the providing of smooth surfaces and design flexibility. Too, shipping costs are reduced due to the lighter weight of these aluminum or magnesium die cast parts. In addition to the gear referred to, the illustration above also includes: wheels, gears, gear housings, shaft housings, brackets, spacers, frames, cutter bar supports, etc.

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

Write today for literature and design information. Quick action on inquiries.

LITEMETAL DICAST, Inc.

A SUBSIDIARY OF HAYES INDUSTRIES

1925 WILDWOOD AVE. · JACKSON, MICHIGAN

PLANT AND EXECUTIVE OFFICES

For more information circle No. 34 on the Reader Service Card

NEW PRODUCTS—

continued from page 64

HARDNESS TESTER

. . . determines workpiece position

A hardness testing machine has been developed by STEEL CITY TESTING MACHINES, INC., that determines the workpiece position before it can operate, necessary in high-production Brinell hardness testing. Cycle time of the unit is two minutes. Colored lights indicate the relative hardness of the part being tested.

Throat depth of the machine is 10", the maximum vertical opening is 14" and loads from 500 to 3000 kg can be applied.

Circle No. 218 on Reader Service Card

DRILLING & TAPPING MACHINE

. . . has full range of automatic controls

A single-spindle horizontal drilling and tapping machine has been introduced by UNIMATIC MACHINE CO., that has a full range of automatic controls and is provided with magazine feed to handle the secondary operations of drilling, tapping, counterboring, burring, countersinking, etc. Capacity of the machine includes .020" to ⅜" drilling in mild steel and up to ⅜" tapping. Speed range is between 500 and 10,000 rpm.

Circle No. 212 on Reader Service Card

NEW PROFILER

. . . for grinding and routing

The Pruitt Profiler #P500, manufactured by TOOL-LAB., INC., features a "guide-button" which makes routing, duplicating and grinding of metals, etc., practically automatic. The unit has a ½ H.P. direct drive motor with continuous, precise speed adjustment from 100 to 45,000 rpm.

Circle No. 220 on Reader Service Card

TAP ATTACHMENT

. . . removes burrs automatically

The Burr-Bit, manufactured by VERNON DEVICES, INC., is now offered in a three-fluted design to fit three-fluted taps. With a Burr-Bit on a tap, a hole can be tapped and deburred in one continuous operation. As the tap is withdrawn from the hole, the Burr-Bit removes the first thread, leaving a perfectly smooth chamfer.

Circle No. 226 on Reader Service Card

UNIVERSAL TESTER

. . . has multi-low-range

The Low Range Universal Tester is a small, compact motorized laboratory instrument that will make tests in tensile, compression, tranverse and shear on any low-strength industrial material. Manufactured by W. C. DILLON & CO., INC., the tester is utilized to test materials up to 300 pounds. The unit operates on the principle of a calibrated pendulum and is accurate to within ½ of 1% of the indicated reading.

Circle No. 215 on Reader Service Card

ULTRASONIC CLEANER

. . . for lab or production use

ALCAR INSTRUMENTS, INC., has developed a new, low cost 50 watt ultrasonic cleaner for small part cleaning, blind hole washing, removal of radioactive contamination and other difficult cleaning.

Circle No. 225 on Reader Service Card

INSPECTION LIGHT

. . . has shadow free beam

New industrial inspection lights from WELCH ALLYN, INC., use hand made, miniature lamps to produce a sharp, clear beam of light. Very small shaft and lamp diameters permit use in cavities which could not otherwise be inspected visually.

Circle No. 217 on Reader Service Card

NEW GAGE BLOCKS

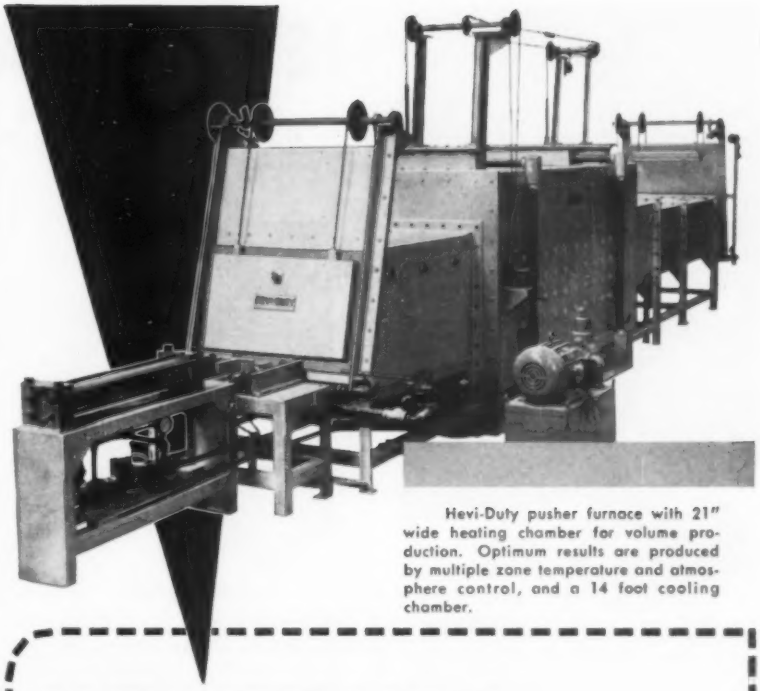
. . . in special ¾" x ⅛" size

New special sets of gage blocks have been developed by Matrix that permit checking of operations where normal size gage blocks are difficult to apply. Distributed by ENGIS EQUIPMENT CO., these smaller units are adapted to high precision measurement of miniature and sub-miniature components, to measurement of chordal dimensions across serrations, etc. The gages can be wrung together to form any combination between .1000" and 1.5000" increments of .0001".

Circle No. 221 on Reader Service Card

OAKITE PROMOTES SEIB AND STEIF

George M. Seib, formerly secretary of OAKITE PRODUCTS, INC., has been appointed vice president of the company, and Erwin H. Steif, who was Mr. Seib's assistant, has been promoted to the post of secretary.



Hevi-Duty pusher furnace with 21" wide heating chamber for volume production. Optimum results are produced by multiple zone temperature and atmosphere control, and a 14 foot cooling chamber.

HEVI-DUTY

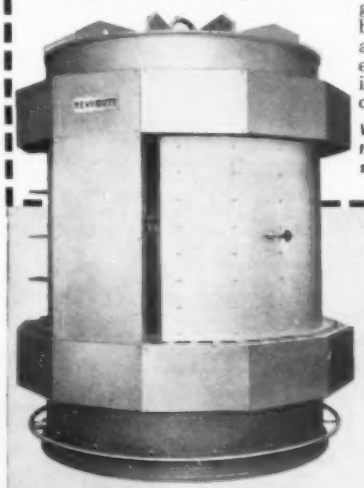
FURNACES FOR SINTERING under a Controlled Atmosphere or Vacuum

CONTINUOUS PRODUCTION FURNACES — Your production sintering requirements can be met by Hevi-Duty pusher or conveyor furnaces; temperatures to 2500°F. Multiple zone temperature control and a variable speed drive will insure uniformly perfect sintered compacts. High temperature electric heating elements reach desired operating temperatures rapidly.

Hevi-Duty exothermic or endothermic atmosphere generators provide the range of gases necessary for sintering.

VACUUM FURNACES — Hevi-Duty pit or bell type double pump vacuum furnaces provide temperatures to 2100°F. Vacuum sintered parts show greater homogeneity and density, and better ductility than those conventionally sintered. This method is often less expensive and the elimination of gas inclusions reduces mechanical or physical defects.

Write for Bulletins 357 and 557 to determine the Hevi-Duty furnace best suited for your sintering requirements.



Hevi-Duty bell type double pump vacuum furnace for sintering at 2100°F. Standard pit or bell type vacuum furnaces are available with uniform working zones up to 54" in diameter by 144" high.

HEVI-DUTY ELECTRIC COMPANY

MILWAUKEE 1, WISCONSIN

Heat Treating Furnaces . . . Electric Exclusively

Dry Type Transformers *Constant Current Regulators*

For more information circle No. 24 on the Reader Service Card

Thousands of extra pours per ladle, with less effort for the operator
the Spincraft STAINLESS STEEL ladle
for non-ferrous metal pouring

LIGHT
TOUGH
LONGER-
LASTING

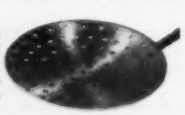
If you pour non-ferrous alloys, Spincraft ladles will save you replacement costs and make the job much easier. Designed to reduce operator fatigue by their lightness, balance, and non-spill shape, they resist burning-through as only stainless steel with its high critical melting point can do. Spincraft ladles come in 23 sizes, from ¼ lb. to 30 lb. molten metal capacity.

- 75% lighter than cast iron ladles
- Amazingly long life
- Shot-blasted for coating adhesion
- Deep conical form makes pouring easier, minimizes spillage
- Can be used for zinc and other metals without coating
- "Whack proof" handle arc-welded to reinforced cup edge
- Built to last longer, work lighter. Let your operator use one, then try to take it away from him!

Complete handle on ¼ lb. through 9 lb. size; 10 through 30 lb. size has handle bracket stub to which proper length handle can be attached.

Also...Spincraft STAINLESS STEEL Skimmer

A skimmer that really skims! Shallow radius skims surface impurities instead of ladling as deeper-cupped skimmers do. Correct size holes prevent clogging. Short handle stubs fit common pipe and permit attachment of length and type handle you want.



IN FOUR DIAMETERS: 6 inch, 8 inch, 10 inch, 12 inch.

Spincraft ladles and skimmers are also available in low-cost mild steel.

Write for complete data and prices today.

Spincraft
DRILL WELL OR IT ®

SPINCRAFT, INC.
4138 West State St., Milwaukee, Wis.

Send us complete information on:

Stainless Steel	Mild Steel
☐ Ladles	☐ Ladles
☐ Skimmers	☐ Skimmers

Company .....

Address .....

City ..... State .....

Name .....

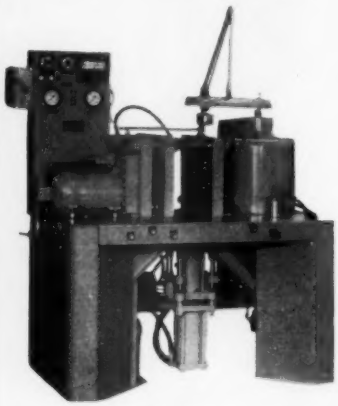
Circle No. 49 on the Reader Service Card

For more information circle No. 31 on the Reader Service Card

LEYDEN WAX INJECTORS

Another New Model!

Horizontal Hydraulic Press With Bottom Injection



Model No. H81WP

Over 200 machines in the field have proved their superiority. Write for complete specifications and features of the Leyden Models vertical platen—side or center injection—horizontal platen—center injection.

LEYDEN wax injection machines are the last word in the field of wax injection. They are the result of years of research and experience.

SOME EXCLUSIVE FEATURES

- Completely hydraulic—operated by self-contained power unit.
- Two hydraulic pumps—one for clamping and one for injection.
- Clamp and injection pressure independently adjustable.
- Entire wax unit heated by circulating oil.
- Thermostatically controlled, electrically heated nozzle—optional.
- Temperature controlled to plus or minus ½° F.
- Agitator spans full diameter of the pot, keeping wax mixed uniformly.
- Universal movement of nozzle to facilitate misaligned dies.

LEYDEN HYDRAULICS, INC.

1800 North River Road • Melrose Park, Illinois

Get the results you want from DIE CASTING...

A partial list of RESULTS you can expect when you specify MILWAUKEE DIE CASTINGS
★ Less Machining
★ Improved Design
★ Closer Tolerances
★ Smoother Finish—at lower cost
★ Stronger Sales Appeal
★ Faster Assembly

When you decide to use die cast parts, you expect, definite *results* in terms of *benefits* reflected in your manufacturing operations, or in your finished products. Milwaukee engineers and technicians, backed by the complete facilities of the modern Milwaukee plant, are qualified by training and experience to give you the results you are looking for... and more!

When you send your prints and "specs" to Milwaukee, you often get more than a quotation. You may get suggestions and proposals, when deemed useful, that will give you all the results you are looking for plus the *extra benefits* which the die casting process can give you.

Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.

ILWAUKEE DIE CASTING COMPANY

4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN

Established 1909

For more information circle No. 37 on the Reader Service Card

PLAST-IRON POWDERS

Grade B-280

Reduced Iron Powder-80

One Pressing at 30 TSI

One Sinter at 2050°F-30M

27,500 PSI Tensil

68,500 PSI Modulus

Rockwell 85H

Add 7% Copper

40,500 PSI Tensil

77,500 PSI Modulus

Rockwell 50B

Send for Technical Data and Working Sample

PM PLASTIC METALS

PLASTIC METALS

Division

National-U.S. Radiator Corporation

1458 BRIDGE STREET

JOHNSTOWN, PA.

Circle No. 39 on the Reader Service Card

GORDON CURRY NEW VICE PRESIDENT OF DOLLIN CORP.

CURRY

Gordon C. Curry has been appointed Vice President in Charge of Sales of the DOLLIN CORPORATION, Irvington, N. J., producers of zinc and aluminum die-castings, where he has been acting as sales manager since joining the company.

Mr. Curry spent 26 years with The Hoover Company, and 11 years with Ainsworth-Precision Casting Company where he acted as Eastern Sales Manager and General Sales Manager prior to moving to the Dollin Corporation. He is on the Board of Directors of the American Die-Casting Institute and was recently elected vice-president.

FOR DIE-CASTERS

• LUBRICATES
• CLEANS

BUILT TO LAST

P-W AIR-LUBE SYSTEM

Patent Applied For

• VAPOR IS ADJUSTABLE
• INCOMING AIR IN TANK AGITATES LUBRICANT

Speeds production and eliminates many causes of down-time through effective cleaning and *adjustable* thin-film lubrication of all mold-cavity surfaces.

PROVED IN USE BY PROMINENT DIE-CASTERS

S-W-I-S-H! One pressure whisks mold clean with powerful air jet. S-W-I-S-H! Further pressure on same lever shuts off air and lubricates.

PIERCE-WALLER CO.

KETTERING P.O. BOX 2121A, DAYTON 9, OHIO

Circle No. 62 on the Reader Service Card

BUYERS' GUIDE

PMM's DIE CASTING DIRECTORY for JANUARY, 1959

Everyone interested in die castings will read PMM's January issue. Buyers and producers of castings alike will keep this issue for year-long reference. Put your ad in the Die Casting Directory issue to sell die castings, dies, metals, equipment or materials.

RESERVE SPACE NOW. Forms close December 1.

Precision Metal Molding

812 HURON RD., CLEVELAND 15, OHIO

An Industrial Publishing Corp. Magazine

Dodge Custom-made **Special Alloy Steel Goosenecks**

. . . for longer service life

. . . less maintenance

Here's the biggest news in die casting in years: a custom-made special alloy *steel* gooseneck that will outlast and outperform iron and alloy iron goosenecks currently available . . . and provide greater operational savings! Developed through years of experience and association with the die castings industry, Dodge Special Alloy *Steel* Goosenecks provide many advantages:

- Will outlast iron and alloy iron goosenecks by as much as 4-5 years.
- Maintenance problems are fewer because of long service life.
- Down time is reduced to a minimum because of long service life.
- Designed and made of special alloy *steel*, they prevent cracking . . . bottom breakout . . . spout erosion.

Each Dodge Special Alloy *Steel* Gooseneck is custom made to specifications by the Finished Products Division of Dodge Steel Company. Facilities are available for producing any size gooseneck for any die casting machine. Goosenecks are furnished either rough machined or machined with sleeves. Dodge provides a complete engineering service in the designing and production of steel goosenecks.

Your inquiries are solicited, without obligation, of course. Ask too, about pots and other die casting machine parts including nozzles, spouts, plungers, etc.

DODGE STEEL COMPANY

DS FINISHED PRODUCTS DIVISION
6501 Tacony Street
Philadelphia 35, Pa.

THE MOST IMPORTANT ALLOY IN A STEEL CASTING IS QUALITY

Circle No. 16 on the Reader Service Card

pmm OPPORTUNITIES

jobs & equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding. 812 Huron Rd., Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSITIONS OPEN

DISTRICT SALES REPRESENTATIVE FOR IRON POWDER

Join a new growing enterprise. Nationally-known corporation offers an excellent opportunity for sales representatives for new iron powder plant. Experience in metal powder field required. Write, stating background, experience and other pertinent details. Applications will be treated confidentially. Manager, Iron Powder Sales, Alan Wood Steel Company, Conshohocken, Pennsylvania.

UNUSUAL MAN

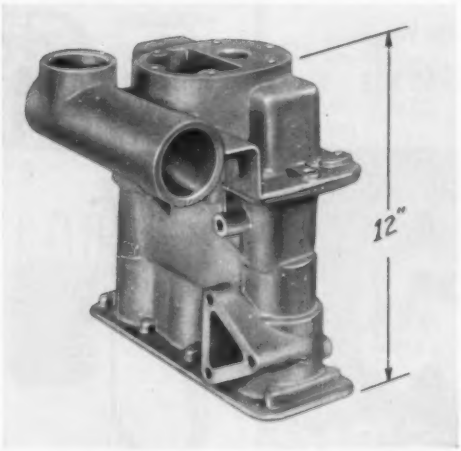
I know of an unusual man in London who can give some American company the fine, dependable representation it has always wanted. This man has a thorough engineering background, was the head of his own business. He is now unhappily situated and wants to make a change.

If you want such a man to run your London office, or if you want to establish an office in Great Britain, drop me a letter. I'll tell you more about him.

IRVING B. HEXTER
publisher

PRECISION METAL MOLDING
812 Huron Rd.
Cleveland, Ohio

WHY ALUMINUM DIE CASTINGS



Today's gasoline pumps require large 300 psi test, castings to supply a better product at a lower cost.

Federal DIE CASTING COMPANY
2220 NO. ELSTON AVE. CHICAGO 14, ILL

RESEARCH PARTICIPANT

Phone AR-6-4803

For more information circle No. 19 on the Reader Service Card

POSITION OPEN

Permanent Mold Foundry Foreman or assistant foreman experienced. Excellent opportunity with growing established company. Give complete reference & experience. Box 11158.

DIE CAST AND PERMANENT MOLD PROCESS ENGINEERS: Supervisor needed for Process Engineering Section, Manufacturing Engineering Dept., of Ford Motor Company's new aluminum casting plant. Send complete resume to Salaried Personnel, P.O. Box 224, Sheffield, Alabama.

Light Metal Die Castings

- ENGINEERING EXECUTIVE
- PRODUCTION SUPERINTENDENT

For position with rapidly expanding medium-size die castings company located in Midwest. Excellent opportunity for participation in growth of company. Must have experience in light metals die casting. State experience, education and salary requirements. Box No. 11258.

EQUIPMENT

FOR SALE

2—Lindberg Radiant Fired Electric Furnaces complete with controls, 440 V, 50 KW. Address: ALUMINUM MATCH PLATE CORP., 1500 MILITARY RD., BUFFALO 17, NEW YORK.

Two Lester 600 Tons HP-3 Die Casting machines, one Zinc, one Aluminum. In every way complete and now in production. Just completely rebuilt and modernized. 1948, and fully guaranteed. Will consider time sale. Have several others for sale. MAGNESIUM INDUSTRIES, South Haven, Michigan, Phone 1163.

50 Used Die Casting Machines; send for list. Will rebuild your machine to your spec's. Fred C. Ziesenheim, 523 King Ave., Marion, Ohio.

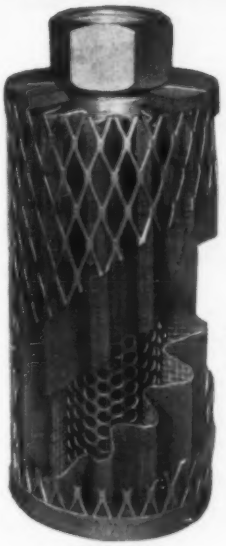
WANTED—USED DCMT. PREFER IMP/96. MUST BE LATE MODEL, GOOD CONDITION. ALSO WANT HOLDING FURNACE. CANTON PRODUCTS. P.O. BOX 981, CANTON, OHIO.

UNIVERSAL-CYCLOPS OPENS NEW SERVICE CENTER

UNIVERSAL-CYCLOPS STEEL CORP. announces the opening of its new Specialty Steel Service Center in Worcester, Mass. The new center has a floor area of 30,000 square feet, more than three times that of the company's previous location in Worcester.

The new larger quarters will enable Universal-Cyclops to carry stocks of approximately 2,000 items of high speed steels, tool steels, and stainless cold heading wire, weighing over a million pounds.

MARVEL Synclinal FILTERS



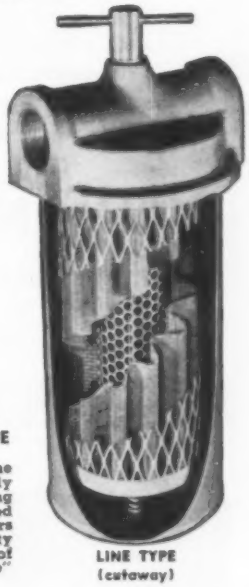
SUMP TYPE (cutaway)

For Efficient Filtration of—

Hydraulic Oils—
Fire Resistant Hydraulic Fluids—
Coolants—Lubricants—
Water

OVER 800
Original Equipment Manufacturers Install Marvel Synclinal Filters as Standard Equipment

Meet J.I.C. Standards



LINE TYPE (cutaway)

PROTECT EQUIPMENT
INCREASE PRODUCTION
REDUCE MAINTENANCE

Marvel Synclinal Filters installed in the sump or on the line preceding pump offer maximum protection on all hydraulically actuated and other equipment utilizing low pressure circulating oil systems. Maintenance and production costs are reduced because MARVEL Synclinal Filters BALANCED design offers greater ACTIVE filtering area with sufficient storage capacity for filtered out damaging particles, thus, longer periods of productive operation are attained at minimum "down time" due to maintenance and repairs.

PRODUCTION ENGINEERS and MAINTENANCE MEN whose job it is to keep production machinery operating at peak efficiency and who have recognized the superiority of Marvel Synclinal Filters in the filtration of hydraulic oils, fire resistant hydraulic fluids, coolants, lubricants, etc. are specifying Marvel Synclinal Filters on all new equipment and standardizing with Marvel Synclinal Filters on all machines within their plants.

Another outstanding reason for their preference is the simple construction of Marvel Synclinal Filters which allows them to be easily disassembled, thoroughly cleaned and reassembled on the spot, by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog.) Choice of Monel mesh sizes range from coarse 30 to fine 200.

IMMEDIATE DELIVERY!

VISIT OUR EXHIBIT — Booth #236
8th NATIONAL PLASTICS EXPOSITION
International Amphitheatre — Chicago, Ill.
NOVEMBER 17-18-19-20-21, 1958

MARVEL ENGINEERING COMPANY
7227 N. Hamlin Ave., Chicago 45, Ill. PHONE: JUniper 8-6023

Catalogs containing complete data available on request

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated:—
☐ Catalog #108—For Hydraulic Oils, Coolants, Lubricants
☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic).
☐ Catalog #301—For Water (PMM-11)

Name .....
Company .....
Address .....
City .....
State .....

Circle No. 50 on the Reader Service Card

STROH

DIE CASTINGS

for

55 YEARS

have combined the experience of the *past* with the vision of the *future.* We are one of the oldest die casting companies in the Mid-West.

ZINC

or

ALUMINUM

We can give you precisely *what* you want *when* you want it.

INQUIRIES INVITED!

STROH DIE CASTING CO. INC.
1112T W. Burleigh St., Milwaukee 10, Wisconsin

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HUDSON BAY

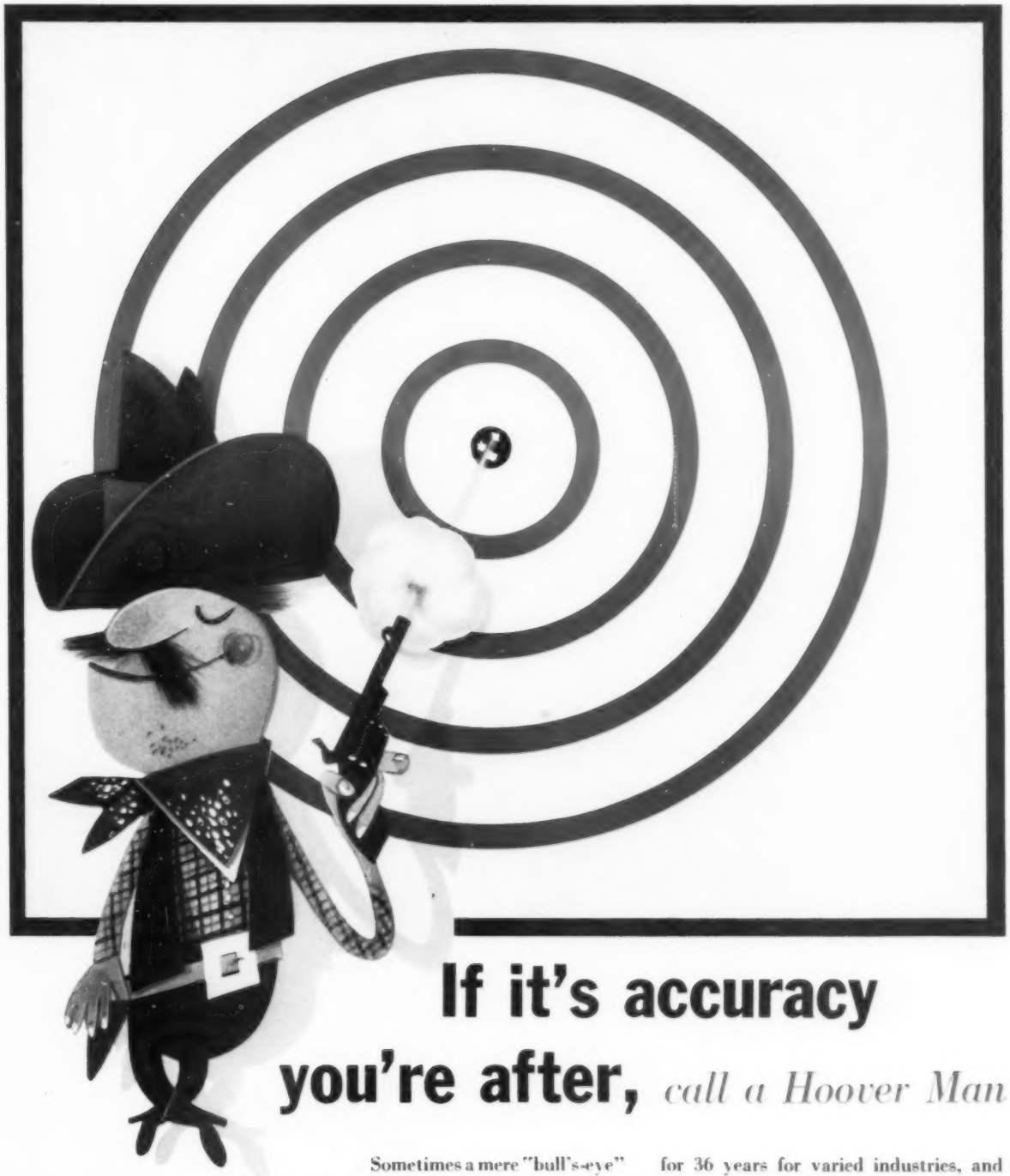
SPECIAL HIGH GRADE ZINC — 99.99%

International Minerals and Metals Corp.

11 Broadway
New York 4, N.Y.

One Fine Zinc For Die Casting

For more information circle No. 28 on the Reader Service Card



If it's accuracy you're after, *call a Hoover Man*

Sometimes a mere "bull's-eye" isn't enough. Die casting can be like that . . . where a little extra accuracy makes a big difference. We've been offering quality aluminum and zinc alloy castings for 36 years for varied industries, and they seem to like our pin-point precision. Maybe Hoover has the answer to *your* die casting problems, too. Why not call one of our Sales Engineers and find out?

THE HOOVER COMPANY, Die Casting Division, North Canton, Ohio
In Canada — Hamilton, Ontario

Die Casting specialists since 1922

DIE CASTING *by* HOOVER

For more information circle No. 25 on the Reader Service Card

THE GODDESS WHO DEFIES THE ELEMENTS

Cast with 6,500 pounds of Apex architectural aluminum, this 31 foot figure of *Ceres*, the grain goddess, stands high atop Chicago's Board of Trade Building—*beautiful and unimpaired after exposure through more than 20,000 days and nights since erection in 1930.* It will outlast the structure it tops.

Ageless . . . in APEX aluminum

The aluminum alloy used for casting *Ceres* still remains in the greatly expanded line of Apex quality alloys. Our customers get the same assured results from its identical characteristics, castability, resistance to corrosion and oxidation. We produce it—and all other Apex alloys—under rigid electronic quality control that gives you *certified* accuracy to specifications.

The tremendous casting of *Ceres* is a dramatic and monumental achievement of the foundryman's art. But to you and to us it is much more important as an example of the alloy quality and dependability known to every Apex customer in his day-to-day production.

Call on Apex. There's long term dependability and scientific leadership back of *every* Apex alloy, whether it's aluminum, magnesium or zinc.

Research leadership back of every ingot

APEX SMELTING COMPANY

Chicago 12 • Cleveland 5 • Long Beach 10, Cal.

Springfield, Oregon (National Metallurgical Corp.)

For more information circle No. 6 on the Reader Service Card